UNIVERSITY OF HELSINKI

FACULTY OF AGRICULTURE AND FORESTRY

DEPARTMENT OF FOREST SCIENCES

PRELIMINARY ASSESMENT OF SOCIOECONOMIC IMPACTS AND PLANTATION PERFORMANCE OF STORA ENSO´S VILLAGE PROGRAM IN SOUTHERN LAOS

MASTER'S THESIS

FOREST ECOLOGY AND MANAGEMENT

Eedla Makkonen

April 2019

Tiedekunta/Osasto Fakultet/Sektion – Faculty Faculty of Agriculture and Forestry	**Laitos/Institution – Department** Department of Forest Sciences	
Tekijä/Författare – Author Eedla Makkonen		
Työn nimi/Arbetets titel – Title Preliminary Assessment of Socioeconomic Impacts and Plantation Performance of Stora Enso´s Village Program in Southern Laos.		
Oppiaine/Läroämne – Subject Tropical Forestry and Agroforestry		
Työn laji/Arbetets art – Level Master's Thesis	**Aika/Datum – Month and year** April 2019	**Sivumäärä/Sidoantal – Number of pages** 55 + Annexes

Tiivistelmä/Referat – Abstract

Laos is one of the poorest countries in South-East Asia. Rural people's livelihoods are mostly reliant on rice production and collection of forest products. There is very little research available about large-scale tree plantations and agroforestry in Laos. However, there is a clear need for information about the livelihood of the local people affected by companies that lease land from the local rural population for large-scale plantations in Laos. Stora Enso (SE) has trial plantations in Laos that combine tree-growing and food production. The Stora Enso Village Program (SEVP) focuses on sustainability that includes community engagement and helping local villagers to farm in safe conditions.

The main aim of this study was to assess the productivity of taungya agroforestry systems in the SEVP trial plantations, and to measure the socioeconomic impacts at the village and household level. The following research questions are addressed: 1. To describe the Stora Enso Village Program in Laos, 2. To evaluate the conditions of the plantations established by SE in six villages in Saravan and Savannakhet Provinces, 3. To evaluate the socioeconomic impacts of the village program at the household and village levels in terms of: *i) What kind of incomes do the local families get? ii) How have the agricultural activities, which are part of the taungya agroforestry system, affected plantation productivity? iii) Who is benefiting from Stora Enso's "village program" and how?*

Six research villages were selected, including five villages where Stora Enso operates and one where the company does not operate. Biophysical plantation measurements were done in 28 study plots in five villages. Plantation production was measured from the trees in the taungya agroforestry areas in each village. In each trial village, the Village Head was interviewed about basic village information such as population, livelihood and geographic information. Two Focus Group Discussions were conducted in each village, with information about villagers' livelihoods and changes to livelihoods after the SEVP was started in the village. Participatory mapping exercises were carried out to determine the location of the households in the villages for random household selection. Interviews were conducted in 15 households in each village (90 households in total) to gather household-specific information such as incomes, livelihood activities and experiences of the taungya agroforestry sites. Village crop production in the taungya agroforestry sites were estimated at the household level.

Results showed that employment opportunities increased in the village mostly in the first years of plantation cycle. The villagers were pleased with the land preparation carried out by Stora Enso and the crop yield in agroforestry areas, however, this was limited to when the plantation trees were smaller. Lack of labour, shade from plantation trees, and long distances to the plantation areas were the main reasons why villagers did not use the plantation areas for crop production. Plantations were generally in good condition, however, there were some insect and other stem damages. Lack of agricultural machinery and big distances from households to the agroforestry areas led to variation between villages´ crop production. There was limited work available for the villagers who wanted to work.

The key findings of this thesis highlight the benefits of extra incomes and work opportunities for the local people in the villages and the positive outcomes in terms of the SEVP funds being used to build infrastructure and schools for the villages. The result of the study shows that the location of the villages affected negatively on villages that were far away from the market place and had limited possibilities to sell surplus crops. Cash crop production only occurred in the villages near the main roads and markets. Long distance to the taungya agroforestry area also limited the usage of the areas.

This study has shown how the SEVP provides some benefits at both the village level and the household level. At the village level - positive impacts from village fund include improved infrastructure such as roads, water systems and electricity, while at the household level, positive impacts include employment opportunities and support to grow crops in the taungya agroforestry system. However, there are also challenges and limitations, such as agroforestry potential for producing crops between tree rows are not fully utilized during tree rotation, and most of the plantation employment opportunities are only available in the first years of plantation establishment. The SEVP is a trial program that attempts to integrate local communities' needs by producing food and cash crops in the plantation area. The concept needs further development, more trials and research to improve the system, but has potential to be replicated in other places. It needs to be designed to suit the specific context of the local communities according to local culture and needs.

Avainsanat/Nyckelord – Keywords
Forest products, plantation, taungya agroforestry, rural livelihoods, Lao PDR, Laos, developing countries, Southeast Asia

Säilytyspaikka/Förvaringställe – Where deposited

Muita tietoja/Övriga uppgifter – Additional information
Supervisors: Prof. Markku Kanninen and Dr. Nicholas Hogarth

Tiedekunta/Osasto Fakultet/Sektion – Faculty Maatalous-metsätieteellinen tiedekunta	**Laitos/Institution – Department** Metsätieteiden laitos	
Tekijä/Författare – Author Eedla Makkonen		
Työn nimi/Arbetets titel – Title Preliminary assessment of socioeconomic impacts and plantation performance of Stora Enso´s village program in Southern Laos.		
Oppiaine/Läroämne – Subject Trooppinen metsänhoito		
Työn laji/Arbetets art – Level Gradu	**Aika/Datum – Month and year** Huhtikuu 2019	**Sivumäärä/Sidoantal – Number of pages** 55 + Liitteet

Tiivistelmä/Referat – Abstract

Laos on yksi Kaakkois-Aasian köyhimmistä maista. Paikallisten ihmisten toimeentulo koostuu pääosin riisituotannosta sekä metsästä kerättävistä luonnontuotteista. Tutkimuksia Laosin plantaasimetsätaloudesta sekä maatalouden ja metsätalouden yhdistäviä tutkimuksia on olemassa hyvin vähän. Vähäisen tutkimustiedon vuoksi on tärkeä kerätä tietoa siitä miten paikallisten ihmisten toimeentulo on muuttunut Laosista maa-alueita plantaasimetsätalouteen vuokraavien yritysten myötä.

Stora Ensolla on Laosissa koeplantaasialueita, jotka yhdistävät puun- sekä ruoantuotannon samalla maa-alueella. Stora Enson kehittämä kyläohjelma keskittyy kestävään kehitykseen, joka pitää sisällään yhteistyötä paikallisyhteisöjen kanssa sekä auttaa paikallisväestöä tuottamaan ruokaa turvallisessa ympäristössä. Tämän tutkielman tarkoitus on arvioida puutuotantoa sekä maataloutta yhdistävän metodin tehokkuutta, mitata sosioekonomisia vaikutuksia niin kotitalous- kuin kylätasolla. Tutkimuksen pääkohtina on 1. Kuvailla Stora Enson kyläohjelma Laosissa, 2. Arvioida plantaasien kunto kuudessa eri kylässä (Saravanin sekä Savannakhetin provinsseissa) ja 3. Arvioida kyläohjelman sosioekonomisia vaikutuksia paikallisväestöön. Tutkimuksen tavoite on lisäksi selvittää i) Minkälaisia tuloja paikalliset ihmiset saavat?, ii) Miten maatalous on vaikuttanut puuntuotantoon alueilla, joilla yhdistyy maatalous ja puuntuotanto? sekä iii) Kuka hyötyy kyläohjelmasta ja miksi?

Tutkimukseen valikoitui kuusi eri kylää, joista viidessä oli käytössä Stora Enson kyläohjelma. Plantaasien metsänmittaus tehtiin 28 eri koealalla viidessä eri kylässä. Jokaisessa tutkimukseen osallistuneessa kylässä haastateltiin kyläpäällikköä. Haastattelun tarkoituksena oli saada selville perustietoja kylästä, kuten asukasluku, yleisimmät toimeentulomuodot ja alueen maantieteelliset tiedot. Ryhmähaastattelut tehtiin jokaisessa kylässä miehille ja naisille erikseen. Kummassakin ryhmässä kysyttiin Stora Enson kyläohjelman yhteydessä tapahtuneista muutoksista toimeentulossa, ympäristössä yhtiön vuokraamien maiden läheisyydessä sekä plantaasien positiivisista ja negatiivisista vaikutuksista. Lisäksi molemmat ryhmät hahmottelivat paperille kartan, missä kylän talot sijaitsivat, jotta kotitalouden satunnainen valinta haastatteluun olisi mahdollista. Kotitalouksia haastateltiin tutkimukseen yhteensä 90 eli jokaisessa kylässä tehtiin 15 haastattelua. Yksilöhaastatteluissa kerättiin tietoa mm. haastateltavan ammatista, tuloista ja kokemuksista ruoantuotannosta plantaasimetsäalueilla. Paikallisten viljantuotanto yhtiön vuokramailla arvioitiin kotitalouskohtaisilla määrillä.

Tutkimukseen osallistuneissa kylissä työmahdollisuudet paranivat ensimmäisinä vuosina, kun yhtiö perusti alueelle uusia puuntuotantoalueita. Paikalliset ihmiset olivat tyytyväisiä maanmuokkaukseen ja riisisatoon plantaasimetsätalousalueilla puiden ensimmäisinä kasvuvuosina. Puute työntekijöistä, puiden varjostus sekä pitkät etäisyydet kylistä plantaasialueille olivat suurimpia syitä, miksi paikalliset eivät halunneet käyttää heille tarjottuja plantaasialueita riisintuotantoon. Plantaasien puut olivat yleisesti hyvässä kunnossa, vaikka puissa esiintyi jonkin verran hyönteistuhoja sekä runkovaurioita. Suurimmat erot kylien välisessä normaalissa riisintuotannossa aiheutuivat maatalouskoneiden puutteesta sekä suurista etäisyyksistä. Yhtiöllä ei ollut tarjota työtä kaikille halukkaille. Tasaisimmat työansiot yhtiölle tehtävistä töistä saatiin kylissä, joissa oli eri kehitysvaiheissa olevia plantaasialoja.

Tämä tutkimus osoitti, että Stora Enson kyläohjelma tarjoaa erilaisia etuja kylille sekä niiden kotitalouksille. Koko kylän tasolla positiivinen vaikutus oli infrastruktuurin kehittyminen, sillä kyläohjelmasta saaduilla tuloilla parannettiin vaihtoehtoisesti joko teitä tai sähkö- ja vesijärjestelmiä. Kotitalouksille positiivisia vaikutuksia olivat mm. paremmat työllistymismahdollisuudet sekä tuki viljelyn aloittamiseen plantaasialueella. Haasteena oli, että plantaasialuetta ei hyödynnetty täysimääräisesti ensimmäisten vuosien jälkeen. Haaste oli myös tulojen painottuminen plantaasien kiertoajan alkupäähän. Yhtiö näyttää muille puuntuotantoyhtiöille hyvänä esimerkkinä, miten samalla maa-alueella voi samaan aikaan kasvattaa puita sekä ruokaa. Kyläohjelmamallia voidaan tulevaisuudessa hyödyntää muiden maiden plantaasiviljelykohteissa soveltaen ohjelmaa kunkin maan kulttuurin tarpeisiin sekä yhteisöön sopivaksi.

Avainsanat/Nyckelord – Keywords

Metsätuotteet, taungya plantaasimetsätalous, maaseudun toimeentulo, Lao PDR, kehitysmaat, Kaakkois-Aasia

Säilytyspaikka/Förvaringställe – Where deposited

Muita tietoja/Övriga uppgifter – Additional information

Ohjaajat: Prof. Markku Kanninen ja Dr. Nicholas Hogarth

LIST OF FIGURES

LIST OF TABLES

FOREWORD

This Master´s Thesis was done as part of a Master´s degree in Forest Sciences at the University of Helsinki, Viikki Tropical Resources Institute (VITRI). I wish to express my gratitude for everyone involved in the process of this work.

Firstly, I would like to express my gratitude to my instructors, Prof. Markku Kanninen and Dr. Nicholas Hogarth from the University of Helsinki. Their help was crucial.

I would also like to thank my field work translator Samlarn Kasyxongdeth from the University of Savannakhet, Lao PDR, whose local knowledge, language and experience in the rural areas was vital for conducting the field work.

Furthermore, I would like to thank the Metsämiesten Säätiö Foundation for the invaluable financial support. Their grant made the field work in Laos possible.

Finally, I would like to express my gratitude to all the staff members in Stora Enso Laos. Without their help and guidance this Master's Thesis would not have been possible to implement.

Tampere, Finland
April 2019

Eedla Makkonen

LIST OF ABBREVIATIONS

NTFP	Non Timber Forest Product
FGD	Focus Group Discussion
HA	Hectare (10,000m^2)
HH	Household
CIA	Central Intelligence Agency
CIFOR	Center for International Forestry Research
FAO	Food and Agriculture Organization of the United Nations
KII	Key Informant Interview
PDR	People´s Democratic Republic
RRA	Rapid Rural Appraisal
IUCN	International Union for Conservation of Nature
SEVP	Stora Enso Village Program
VITRI	Viikki Tropical Resources Institute

1. INTRODUCTION

The global spread of tree plantations is increasing annually. Wood sourced from tree plantations makes an important contribution to the world's growing demand (Atanga et al., 2014). Latest estimates placed the global spread of planted forests at 278 million hectares in the year 2015 (Payn et al., 2015; Malkamäki et al., 2018). Poverty and population growth of local people have led to increased pressure on tropical natural resources (Atanga et al., 2014). The world's rapidly growing population is not only facing a lack of wood products, but also challenges related to food production. Food security is one of the biggest issues today, particularly in developing countries where there is high population pressure and less space for production. Over the past several decades agroforestry systems have been proven for producing both wood and food for smallholder farmers throughout the world (Atanga et al., 2014).

Large-scale tree plantations have been subject to controversy due to their socioeconomic impact since their prevalent introduction in the 1980s. With plantation establishment on the rise, more information about impacts on local communities is needed to inform about practices and policies (Malkamäki et al., 2018). Most of the large-scale plantations are located in Americas and Asia and they capture from hundreds of hectares to thousands of hectares under commercial or government management (Kanowski and Murray, 2008; Malkamäki et al., 2017). These plantations usually consist of a few relatively productive and predominantly exotic tree species or single monoculture, which are intensively managed, mainly for pulpwood, timber and biofuel purposes and also for carbon credits (Batra and Pirarad 2015; Borras et al., 2015; Ingram et al., 2016; Malkamäki et al., 2017).

Tropical countries that depend on wood supply from natural forests have noticed the importance of planting trees as forest activity (Günther et al., 2011). In the year 2012 large-scale tree plantations occupied a total of 54,3 million hectares of land (Indofur, 2012; Malkamäki et al., 2017). Most common tropical plantation species are fast growing and the growth can be improved substantially through silvicultural activities such as site nutrient management, and by using matching or hybrid species etc. (Günther et al., 2011). Previous studies have shown socioeconomic impacts of large-scale tree plantations to be in large measure mixed across managerial and geographical contexts with the potential to cause both negative impacts (such as

conflicts from lost access to land) and positive impacts (such as rural economy revitalization) on local people (Cossalter and Pye-Smith, 2003; Charnley, 2015; Schirmer, 2007; Geber, 2011; McDermott 2012; Malkamäki et al., 2017). Large-scale tree plantations have developed opposition movements in civil society, which consider their establishment a negative trajectory for development in rural areas (Schirmer, 2013; Malkamäki et al., 2017). This has encouraged efforts to design and manage better plantations, that would contribute socioeconomic and environmental conditions locally (Paquette and Messier, 2010; Schirmer et al., 2015; Ingram et al., 2016; WWF, 2016; Malkamäki et al., 2017).

The Lao People's Democratic Republic (henceforth referred to as Laos) is one of the poorest countries in Southeast Asia. The country's economy is strongly based on natural resources (OECD, 2014). Sustainable management of forests and related resources and improving people's livelihood is part of the country's strategy to achieve its Sustainable Development Goals (SDGs).

Forest plantation area of Laos (rubber, timber, agarwood, etc.) has cautiously increased from under 10,000 hectares in the 1990s to around 446,000 hectares in 2016 (Hansen et al., 1997; Earth Systems, 2016; Arvola et al., 2018). The share of trees planted by entrepreneurs and individual farmers in this increase is estimated to be 47,5%, thus the figure is only an irregular approximation since only 10% of smallholder plantations are registered (Smith et al., 2017b; Arvola et al., 2018). More than 50% of the plantation area increase is due to rubber plantations.

A 2012 moratorium (PM Decree 13, extended in 2015), on new land concessions, including eucalyptus and rubber, has slowed the progress of the sector, even though two companies – Burapha Agroforestry and Stora Enso Laos – were exempt based on their agroforestry models (Vientiane Times, 2016; Barney & Van Deer Meer, 2019). These companies, alongside with the Mekong Timber Plantations Company, are at the moment exploring options with The Government of Lao PDR to extend a participatory agroforestry allowance approach into Production Forest Areas (Barney & Van Deer Meer 2019).

Nowadays Laos wood industry consists of furniture factories, medium and small-sized sawmills and plywood and other wood based panel production (Redman et al.,

2014; Arvola et al., 2018). Other large scale eucalyptus plantations in the country are run by Burapha Agroforestry. The company has operated in Laos since 1989 and acquired 7,700 hectares of land areas, of which 3,000 hectares of land is planted (Burapha 2019).

Figure 1 Rural area of Laos.

1.1 *Stora Enso Laos operations*

Stora Enso (SE) is an integrated paper, packaging and forest products company, which is a global market leader in the production of publication and fine papers, packaging boards and wood products. Materials are renewable, reusable and recyclable. The company is pushing towards carbon neutrality in production, as much as it is commercially and technically feasible. Stora Enso promotes and practices sustainable forestry. Sales in 2017 were 10 billion Euros. The company has 26,000 employees in more than 30 countries (Stora Enso, 2018).

Most of Stora Enso´s sales and operations are located in Europe and the head office is in Helsinki, Finland. The company has wide experience in management of broad scale eucalyptus plantation programs in Portugal and Brazil. It has expanding interests in South America and has started commercial eucalypt plantations in Rio Grande do Sul in Brazil and in Uruguay. The company manages eucalyptus plantations in southern China, which will be used as the supply base for a proposed pulp mill in Guangxi, China.

In 2005, the company started to plan to expand their business in to the Lao PDR forest plantations of eucalyptus and acacia. The tree plantations were planned to produce wood for international and regional markets. In Laos the company started trial tree plantations that combine tree-growing and food production. The idea is to produce wood for commercial use and produce food in the same land area. Focus on sustainability includes community engagement and helping local villagers to create safe farming. According to the Lao law, all land in the country is formally owned by the government. Private and juridical persons can secure land use rights. In remote areas, traditional land use rights to family plots of land are widely respected in the program (Stora Enso, 2017).

1.2 *Agroforestry systems*

Agroforestry refers to a land-use and cultivation system which combines woody perennials like shrubs and trees with crops or pastures. In some specialized systems, there can be also other components like fish or bees (Young 1991, 11).

There can be multiple tree and crop species grown together; there are systems with some trees growing on predominately cropland and taungya systems whereby the trees are small and widely spaced. A seasonal crop can be placed in free space between newly planted trees. Another practice is where trees can be used as shelterbelts from wind or sun around and on cropland. Agroforestry can also mean mixture of trees and livestock. Trees can be used as a fence for livestock in terms of protection from predators but also livestock limitation from damages for cropland caused by free grazing. There can be trees grown on pastures to provide fodder and shade livestock, which is called silvipastoral system (MacDicken, Vergara 1990, 23-25).

The word agroforestry has its roots in the definitions of agrosilviculture and agrisilviculture and the practice is land-use systems, technologies and practices, where the woody perennials (trees, bamboo etc.) are purposely integrated with animals and/or agricultural crops in the same land area. Agroforestry is different than social forestry, which is the way of using trees and/or planting to follow social objectives, through convenience of the local people (Atanga et al., 2014).

Shifting cultivation is presumably the oldest farming system and it is significantly similar throughout the tropic areas (Palm 2005). A popular tropical procedure

consists of growing food crops during two or three seasons on a specific land area, and then leaving the area in fallow for 7-10 years to improve land fertility, while other land areas are used for crop rotation. Local farmers slash and burn approximately a hectare of secondary or primary forest (Palm 2005). Ground vegetation is removed by clearing and burning before the area is used for cropping. Common shifting cultivation crops in the tropics are cassava, yams, rice, maize and bananas. Shifting cultivation crops are primarily used for consumption of the farmers, and secondarily for cash purpose (Atanga et al., 2014).

Figure 2 Shifting cultivation in Pitiean Village, Ta Oi District.

Long-term removal of forest cover is called deforestation, whether it is done anthropogenically or naturally and conversion to a non-forestall land use. Forest degradation subscribes changes within the forest that affect negatively the function or structure of site by lowering the capacity to supply services and/or products. Increasing of slash and burn agriculture in cultivation areas cause 8% of forest cover losses. In Asia, 65% of forest loss was caused by land use change to agriculture, while 23% of the loss was directly from impact of slash and burn agriculture (Atanga et al., 2014)

Taungua system is an example of combining woody plants and annual crops. Annual crop system is dependent on space and light and it is based on spatial tree arrangements. This system is an alternative to shifting cultivation. In the taungya

system, annual agricultural crops are cultivated along with the forestry species only during the early years of establishment of the forest plantation. In Asia the most common taungua system crop is rice (Atanga et al., 2014).

1.3 *Plantation management*

Usually the purpose of plantation is one of the following four groups: (1) wood production for industrial purposes, (2) interior wood production, (3) protection of environment, and (4) development of rural areas. An additional purpose of carbon sequestration by forest plantations is increasing in recent years (Günther et al., 2011, 403).

Tree planting in tropical countries is a progressively important forestry activity. Many countries in tropical areas are countries in transition phases or developing countries. Tropical forest must fill livelihood needs in many cases and the areas suffer from constantly higher human pressure. These forests are sparsely surrounded by humans were the final local savior can be done economically, socially, spiritually and culturally ways. In densely populated Southeast Asia tropical forests are vulnerable to degradation caused by fuel wood collection, illegal logging and grazing (Günther et al., 2011).

Eucalyptus is the most grown tree species and is promoted by both private sector and public. This tree species is shade-intolerant and light-demanding which correspond well to heavy thinning. Eucalyptus has a white trunk bole and it can grow up to 45-65 meters high. It has an open-crown construction (Günther et al., 2011, 465).

Tropical plantation establishment depends on sufficient site preparation. This is important especially for eucalyptus. To achieve significant growth rates eucalyptus site requires well-cultivated soil and weed-free conditions. This can be achieved mechanically, manually or by using specific chemicals (herbicides) (Günther et al., 2011, 415-417).

Weed control is important until canopy closure. Best results are established when there is a one-meter diameter weed-free zone around every tree trunk from the time of planting until the canopy closure. Weeding can be done manually, mechanically or by using specific chemicals (herbicides). The intensity of weed control varies according to site, climate and species. Fire damages are often heavy in plantations that are poorly maintained, and a large amount of fuel from woody litter and garbage

is available. All tropical plantations will claim protection from pasture animals, domestic or wild livestock until trees are strong enough to resist damage or they are at least four meters tall. Shepherding and fencing are commonly used to prevent damage to the trees. Many tropical plantations suffer from local control and termite damage, e.g., by termiticides, is necessary. Plantations should be managed by keeping them in a productive and healthy condition, where disease and pests are kept at low levels (Günther et al., 2011, 417).

Plantation rotation length is the total number of years between establishment and clear-cut. Tree size control is important: the longer the rotation time will be, the larger the trees will grow. Rotation age in plantation management is defined by multiple factors, such as site quality, species, environmental conditions profitability and fiber production. Primary rotation age determiner is profitability. High density, short rotation plantations, especially energy plantations have a 3-5-year rotation. High-value timber plantations, such as teak have a rotation time of up to 100 years. Rotation length is closely related to the proposed end-use of the plantation products and tree species (Günther et al., 2011).

Coppice management is operation of felling trees and renew them through coppices. The originally planted trees are felled in coppice management and the next crop develops from the powerful shoots (coppice) that sprout from the stumps. To achieve good coppice sprouts, dominant and healthy trees should be felled and used and this should be conducted during the rainy season. Sumps should be low and clean, without tearing of the bark. Quality of the mother tree affects the growth and quality (Günther et al., 2011, 440).

1.4 *Aims and objectives*

The purpose of this study is to understand the positive and negative impacts of Stora Enso´s Village Program (SEVP) on the local people in Southern Laos.

The research objectives are designed to improve the knowledge and understanding of the socioeconomic impacts and productivity of taungya agroforestry systems of Stora Enso´s Lao operations on the local villages, as follows:

1. To describe the SE village program in Laos.

2. To evaluate the condition of the tree plantations established by SEVP in five villages in Savannakhet and Saravan Districts.

3. To evaluate socioeconomic impacts of the Stora Enso Village Program (SEVP) at the household and village levels in terms of a) household income, b) how have the agricultural activities, which are part of the taungya agroforestry system, affected plantation productivity?, c) who is benefiting from the Stora Enso Village Program (SEVP) and how?

2 METHODS

2.1 *Site selection, sampling and data collection*

The study was carried out in Sepon and Ta Oi Disctricts in Southern Laos (Figure 3). The following village descriptions are based on Key Informant Interviews (with district officers), household interviews, Focus Group Discussions and observations that were made during the visits in the villages.

The data collection was done as primary data during the researcher's field work. Qualitative data was collected by household and group interviews. Quantitative methods were used to collect plantation data by plot measurements.

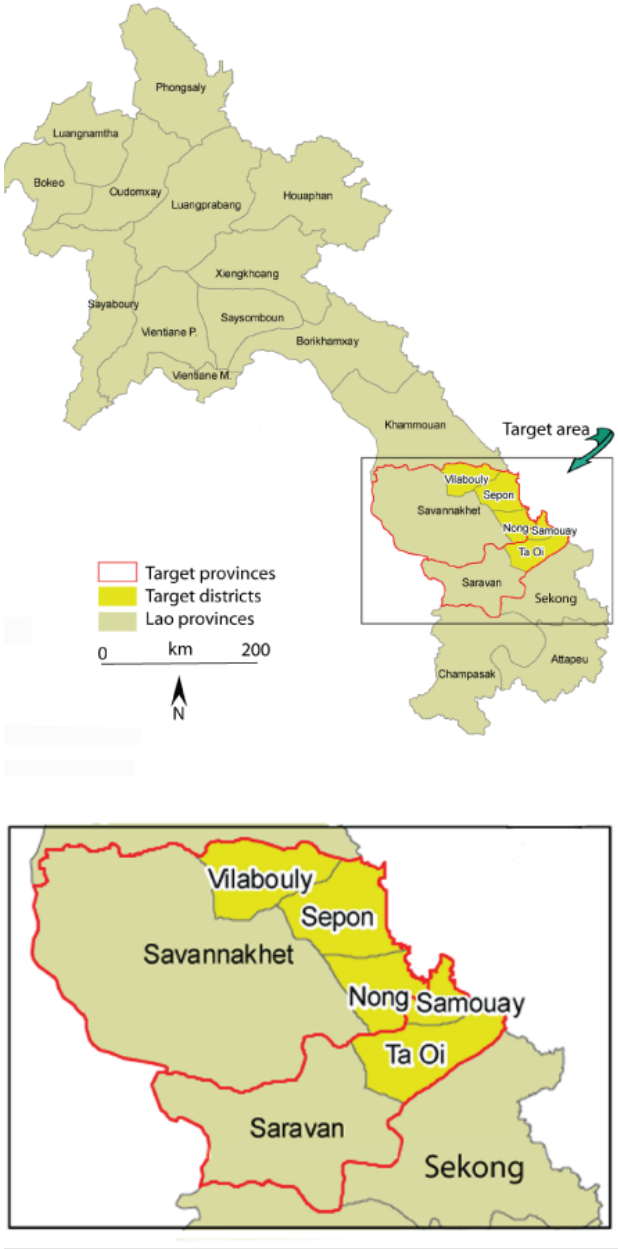


Figure 3 Location of the tree plantations and SE target area (Salwood 2008)

2.2 *Sepon District*

Sepon District is located in Savannakhet Province (Figure 3), near Vietnam border. District information is based on the head of Environmental Office of Sepon District officer's interview results. The total area of Sepon District is 2,570km^2. At the time of the field work there were 88 villages and the total population was 52,696 people, of which 52% were men. The area had three different ethnic groups: Budhai, Munghog and Try. In past years, the local lifestyle was based on natural resources (shifting cultivation and gardens) and there were no investors in the area. There was electricity in the district area. Water for every day usage came from the local river, thus some villages got water from the mountains and transported water down to the villages. Drinking water was purchased from the store or water was boiled before use. Big trees had decreased on the area, since the locals sold timber to Vietnamese and therefore logged too many forests. In the year 2016 authorities prohibited logging of large trees in the district. At the time of the interviews, a Vietnamese cassava factory operated in the area and acquired material from local people. The company did not have its own rental land areas. Five foreign companies leased land from local villages and cultivated tree plantations in the area.

Stora Enso had rented 334 hectares of land in Sepon District. The company started actions in Sepon District in the year 2010. First land rent contract was made in the year 2011. The District made land rental contracts for mountain area only.

2.3 *Ta Oi District*

The following information is based on the head of Agriculture and Forestry of Ta Oi District officer´s interview. Ta Oi was the poorest district in Laos and had not developed as fast as the others. The total land area in Ta Oi District was 293,000 hectares with population of 31,911 inhabitants. Agricultural area was 36,000 hectares and forest area 117,000 hectares. Most of the locals got their livelihood by growing rice, banana or rubber. The local people had poor general knowledge and low level of education which made farming more challenging. The government's future policy aimed to increase the livestock population to accelerate economic growth and increase food production with larger rice yields.

According to the District officer, Stora Enso has started its actions in Ta Oi district in the year 2005. There were four different investment companies in the area that produced bananas and eucalyptus.

2.4 *Village selection and village description*

The trial districts were chosen randomly from Stora Enso's operating area after RRA[1] in the district before choosing the villages. RRA took a brief look at the villages: location, infrastructure, population and other village related things. Two different districts were chosen: Ta Oi and Sepon. RRAs were made in eight villages in Sepon District and in 24 villages in Ta Oi District. The research was executed in total of six villages: four in Ta Oi district area and two in Sepon District area (Table 1).

In Sepon District two villages were selected: Muangsean and Muangchang. These villages where of similar size and had similar land areas. Muangseang was not part of the SEVP because the first plan was to compare the differences between villages that rent land areas to Stora Enso and villages that do not have any contact with the company. As the research proceeded, the original plan needed to be changed, since there was not enough information available of the villages that were not cooperating with the company. There were no tree plantations in the Muangseang village and that is why there was one extra plantation area in the village nearby called Keingluang.

In Ta Oi four villages were chosen: Kacham, Sanya Yon, Lapeung and Pitiean. These villages were located far apart from each other (Annex 10). Half of Kacham village participated in the SEVP. The villages were selected to see whether there were any differences inside each village. Sanya Yon Village had the smallest population and was a model village of the government. The village was selected to discover whether it was more advanced than the other villages and if a small population causes differences between villages. The village of Lapeung was selected since the company had trials of pineapple and rattan cultivation as part of the agroforestry systems. The purpose was to find out if the trials were useful for the villagers. Pitian Village had recently moved closer to the main road and the plantation areas were left near the old village. The village was selected to see whether there was any change after the village migrated away from the plantation area.

[1]Rapid Rural Appraisal (RRA) is a series of techniques for quick appraisal, evaluation and identification of information on rural resources for planning action. It is most popular participatory diagnosing method used in researches of agroforestry (Atanga et al., 2014, p 249).

Table 1 Sample villages in Savannakhet and Saravan Province.

Province	District	Village	No. of sample households	No. of households
Savannakhet	Sepon	Muangchang	15	173
Savannakhet	Sepon	Muangsean	15	258
Saravan	Ta Oi	Kacham	15	22
Saravan	Ta Oi	Lapeung	15	44
Saravan	Ta Oi	Pitiean	15	35
Saravan	Ta Oi	Sanya Yon	15	18
TOTAL			90	550

Muangchang Village

Muangchang village had 179 households and 1,069 inhabitants. All the villagers spoke Lao´s language and the village language interpreter was not needed in the interviews. Ethnic groups were Ta Oi ethnic, Phoothai and Tree. The village was situated nearby mountains, where the locals cultivated rice. The local school was founded by UNICEF. The village was situated near a good main road. Rice was the most important crop for food and cassava was grown as a cash crop. Labour work was one of the biggest income sources after farming. Few families were highly dependent on the cassava factory incomes. The village also had a company that rented land areas and produced rubber. Stora Enso started SEVP in the year 2007. The company had 20,7 hectares of land areas and the village fund was used to build a well into the village.

Muangsean Village

Muangsean Village was the largest village by its 4,169 hectares, including mountain area. The village had 258 households and 1,295 inhabitants. All the villagers spoke Lao´s language and the village language interpreter was not needed in the interviews. Main ethnic group was Phuthai. The village was situated nearby Muangchang Village near the main road that was in good condition. Good road connection had developed the village positively. Main income sources were farming and labour work outside the village, since there was no work available in the village. There was a school in the village that needed renovation in order to expand. There was electricity in the village. There were no investment companies in the village.

Pitiean Village

Pitiean Village had 35 households with the population of 253 inhabitants. The main ethnic group was Ta Oi. All the villagers did not speak Lao´s language for which reason village language interpreter was needed during the interviews. Villagers got their livelihood from farming, handicraft production and NTFP´s collection and sales. The village had a well. Pitiean Village had recently moved near the main road. The District government urged the village to move closer to the main road, so it could develop and have a better infrastructure. The village received help from government to move the houses near the main road. Small village school of 62 students was located far in the former village.

The SEVP started in the year 2012. The village fund money was used to build a road to the former village. The company had 25 hectares of land areas in the village. The village was far away from the plantations and the villagers had to walk far on foot to work in the plantation area. The only machine in the village was a tractor owned by the village head. Within the village there were two different units that participated in the SEVP.

Kacham Village

The Village of Kacham was divided into two parts, which were located across the river. Only one part of the village participated in the SEVP at the time the research was done. The part of the Kacham Village that participated in the SEVP had a bad road and the village did not have a bridge. The area could not be reached during the rainy season, when the water level is very high. The other part of the village was located on the main road, along good connections. Both parts of the village had electricity available. Part of the village fund money was used to bring electricity to the village. People outside the village program were allowed to use the land of Stora Enso for agriculture with permission of village head. There was a school for all the children in the village. All the villagers did not speak Lao´s language and village language interpreter was needed during the interviews.

Kacham Village had 22 households participating the SEVP with population of 176 inhabitants. The combined area of both villages was 1190 hectares. The main ethnic group was Katang. The livelihood of the villagers came from paid employment and livestock sales. Stora Enso had 90 hectares of rental land areas in the village. The project started in the village in 2013.

The non -SEVP part of the village had 45 households with population of 428 inhabitants. The main ethnic group was Ta Oi. According to the village head, non -SEVP part of the village were not allowed to use the rented land areas or work for the company. The non -SEVP part of the village did not participate the program because majority of the villagers did not want to join. Main income sources of the villager came from sale of hunted animals, timber and handcrafts.

Lapeung Village

Lapeung Village had 44 households with population of 268 inhabitants. The main ethnic group was Ta Oi. Most of the houses had access to electricity. The main income sources, after farming were labour work for Stora Enso, sales of livestock and NTFP´s. There had been various development projects in the village, such as rice bank and cattle breeding projects. The village had its own school for children. Mainly women did not speak Lao´s language and village language interpreter was needed during the interview situations

The village program started in Lapeung Village in 2010. The company had 16 hectares of tree plantations in the village. The village led to a bad road. Village found money was used to buy cows and borrow money to villagers invests. The company had pineapple and rattan trial area in the village. The area had been planted in pineapple so that villagers could see, by way of example, how to grow shade tolerant plants. The trial area was surrounded by a fence. The whole village participated in to the SEVP.

Sanya Yon Village

Sanya Yon Village had 18 households with population of 108 inhabitants. Sanya Yon was a model village of the government, for which reason every household had its own toilet and water system. The village had its own school for children. Villagers were very active to participate in new projects. Mainly women did not speak Lao´s language, for which reason village language interpreter was needed during the interviews. Main income sources after farming were paid employment and sales of NTFP´s and livestock. During the research, new main road was built in the village, which opened new markets for the villagers to sell their products. Small roads in the village were not in the best condition. According the village head all villagers participated in the SEVP by working for the company. The company started operating in the village in 2011, leasing 47 hectares of land. Project fund was used to buy two cows for every household.

2.5 *Household selection*

Key information about population and households was obtained from the village head. Only one village had a map of the area and households. Due to missing map data villagers were asked to draw a map of the village in the Focus Group Discussions. Each group drew a rough map showing where the households were located in the village. Following this, 15 trial households were selected randomly from each village. Sanya Yon Village only had 18 households, and therefore household surveys were done in every household, excluding the households of village head and two vice presidents (because they participated in the Key Informant Interviews).

2.6 *Socioeconomic data collection*

Primary data was collected using Key Informant Interviews, FGDs and household surveys. Before the fieldwork could start, written permission from government officials was needed. Local authorities of the districts provided basic information about the area in Key Informant Interviews.

Key Informant Interviews

Before entering the villages, government permission was obtained in Savannakhet from the head of the Sepon District Environmental Office and in Saravan Province from the head of the Ta Oi District Agriculture and Forestry Office (DAFO).

Other vital information about the villages and their plantation areas came from the workers of Stora Enso Lao. Workers of the company were interviewed by Key Informant Interviews. The employers were a plantation manager, land use manager and a district manager. Representatives of the NGO Village Focused International (VFI) and a local volunteer of Health Poverty Action were interviewed to get external opinions about SEVP and the tree plantations.

The interviews were conducted from February to April 2017. The length of Key Informant Interviews was about 45 minutes. All the answers were written down. The Key Informant interview questions are provided in the Annex 1. The interviews were qualitative and the interview questions were mainly a guideline for the interviews.

Before entering the households, the village head was asked for a permission to enter the village. After the permission, Key Informant interview was made with the village head. In every village basic information, such as population, crop yield amounts, infrastructure and employment, was collected from the village head.

Focus group discussions (FGDs)

One qualitative research method is focus group, where there are typically six to eight participants with similar characteristics or backgrounds. FGDs create open line communication across individuals to yield data that would not be able to collect via other approaches, such as personal interviews. This kind of discussion can offer powerful insights into people´s feelings and thoughts and give more detailed, richer and nuanced understanding on the ideas of respondents (Lawrakas, 2008, 286).

FGDs were carried out following village head interview. Two separate FGDs were conducted in each village: male and female (Figure 4), with a total of 12 FGDs.

Figure 4 Women's Focus group draw village area on paper in Sanya Yon Village, Saravan Province.

Household surveys

The household interviews followed the village head interviews and FGDs. Household interview were aimed to get more detailed information about household´s livelihood and Stora Enso plantation usage. In each village, the goal was to do 15 household interviews. Total amount was 90 household interviews. In the household interviews the villagers were asked about the education level and income sources, such as crop yield and animal amount. Questions were aimed to get information about crop yield in the plantation area and incomes that the villagers have earned by working for the company (Annex 3).

2.7 *Plantation performance data collection*

In the Stora Enso taungya agroforestry scheme eucalyptus trees are planted in rows, nine meters apart (Figure 5). That leaves four-metre-wide agricultural areas where crops are planted. The model is based on wide spacing between trees, 9 x 1 meters (1,111 seedlings per hectare). The company gives possibilities to plant crops between the tree rows. In the taungya agroforestry system the crops are planted and managed until the tree canopy closes. A farmer can normally grow crops during two to three years after planting the trees. The trees need a one-meter buffer zone free from crops on both sides of the tree trunk. The roots must have two meters of undisturbed soil. Villagers can plant seven meters between the tree rows. After the tree canopy has closed, the cattle can eat grass in the area during four to five years, before the trees

are harvested. Villagers have access to the taungya agroforestry area the whole renting time, but they cannot cut the trees. Expected rotation period for trees is six to seven years and that makes 24 m^3 per hectare per year. The diameter of the trees before clearcutting is normally about 18-20 meters and the height is about 18 meters. The number of sample plots measured per village is provided in Table 2.

Figure 5 Taungya agroforestry: tree rows with three-year eucalyptus in Muangchang Village, Savannakhet Province.

Sampling

The idea of the research was to compare usual plantation areas to Stora Enso´s taungya agroforestry system, thus as the research proceeded, it was discovered that it was not possible to use the plantation areas of other companies. In Savannakhet Province plots where selected by random selection and the villagers did not participate to the measurement. Farmers were interviewed about the crop production. Families that remembered the used taungya agroforestry area in Saravan Province presented the area before plot measurement. The villagers estimated the crop yield amounts of the area. The idea was to find out, does intercropping system produce more incomes or food for the farmers. All the tree data was processed in the same calculations. In each village, the productivity of the plantation site was measured by the rice yield and by measuring the trees.

In Sepon district there were a total of nine measured plots in Muangchang and Kienluang Villages. In the Ta Oi District there were measured 16 plantation measurement plots in a total of four villages: Kacham, Sanya Yon, Pitiean and

Lapeung (Table 2). Measurements were done by random plot selection in Muangchang and Kienluang, where villagers did not show the used area.

Table 2 Number of plantation sample plots measured

Province	District	Village	No. of sample plots
Savannakhet	Sepon	Muangchang	3
Savannakhet	Sepon	Muangsean	0
Savannakhet	Sepon	Kienluang	5
Saravan	Ta Oi	Kacham	7
Saravan	Ta Oi	Lapeung	7
Saravan	Ta Oi	Pitiean	3
Saravan	Ta Oi	Sanya Yon	3

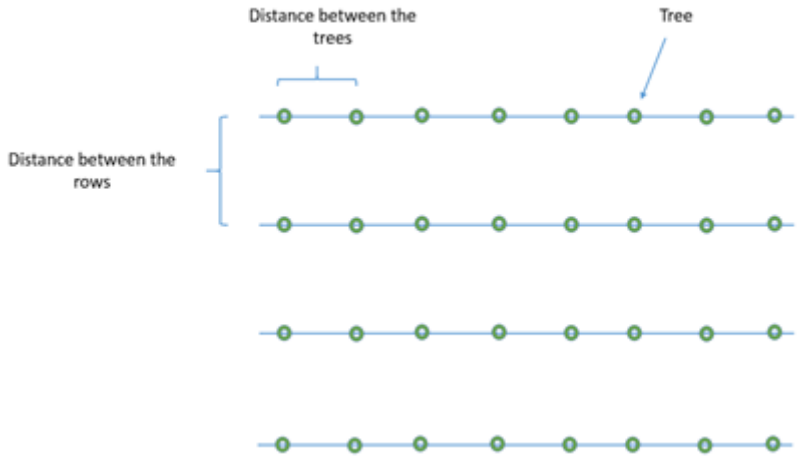


Figure 6 Plantation scheme demonstration of tree measurement

In every plot the following was measured: tree height and diameter, distance between the rows and trees, basal area and root space (Figures 6 and 7). Observations were made from every plot: such as condition of the trees, broken brunches, insects or other problems in the area.

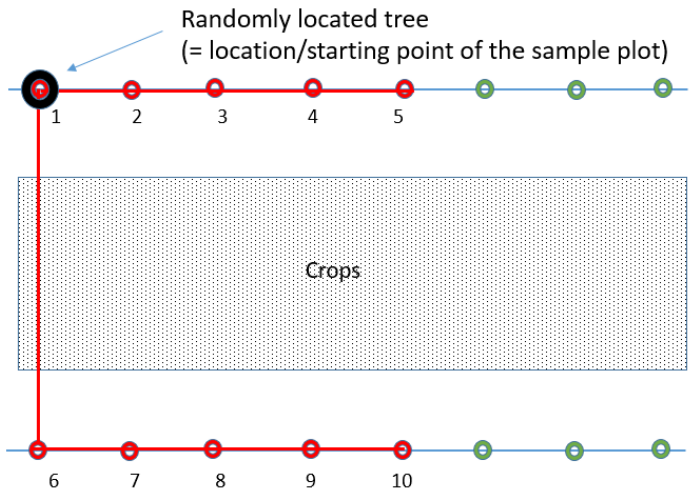


Figure 7 Demonstration of the plantation measurement

2.8 *Data analysis*

The measured and collected data was digitalized from paper sheets to database in MS Excel as two separate categories: household survey data and plantation data. From the measured data, defect classes were categorized in the tree data to allow further analysis. Average tree height was estimated for each tree by forming a formula based on measured tree diameter and height, by creating correlation of height and diameter for each plot. Volumes were estimated by using measured height (H) and breast height (D) tree diameter.

$$V_{total} = 0.00004425 * D^{1.950} H^{1.011}$$

The basal area was calculated for each plot by measured diameters at breast height (DBH). Basal area shows the total area covered with tree stems cross sections of hectare. The tree data was calculated per plot and hectare units were also calculated. Remarkable distances and tree size differences were excluded from tree row, basal area, tree volume and tree distance calculations.

Household survey data was transformed into digital form in MS Excel and the households were separated by identification numbers. The household data was further analysed in MS Excel. Income data was collected on the categories of general info, incomes and taungya agroforestry section.

3 RESULTS

3.1 *Stora Enso Village Program in Laos*

Stora Enso Village Program (SEVP) is located in southern Laos, in an area spanning from Lao to Vietnamese border to Annamite mountain range to the Mekong River and east and the Thai border (Figure 3). Savannakhet is Lao PDR´s largest province with the population of 824,662 people. The province is divided into 15 districts. It has a total of 1,543 villages and 132,301 households, with an average household size of 6.3 persons. The population of Saravane Province is 324,470, and it is divided into eight districts of a total of 724 villages and 53,141 household. The average household size is 6.1 persons.

Stora Enso started planning the Village Program pilot phase in 2005. The pilot phase included development of tree plantations in Savannakhet and Saravane Provinces and development of supporting infrastructure and roads, including project offices and nursery facilities. Current activities involve maintenance of plantation areas, continued demonstration of the plantation model, species and provenance trials and also surveying and planning for the larger plantation area.

Stora Enso Lao (SEL) eucalyptus and acacia plantations cover 2,950 hectares in the year 2017 and have 191 plantation stands in 47 villages. The company uses clone eucalyptus between *Eucalyptus camalduelensis* and *Eucalyptus deglupta* in the majority of plantations. It impacts 70+ villages and over 100,000 people in Laos. The company is considering expanding operations to 15,000-18,000 hectares by the year 2020. Fast-growing hardwood plantations are in the Vilabouly, Xepon and Nong Districts of Savannakhet Province and Ta Oi and Samoy Districts of Saravanh Province in Lao PDR (Figure 3). SE has created a system of village development funds to help improve the living conditions of the villages, e.g., by providing electricity, running water, infrastructure etc.

The intercropping system is a taungya agroforestry model that aims to improve the welfare of local communities and increase yields of rice and other crops while producing wood at the same time. This model lets up to 70% of the plantation area to be used for community agriculture crops owned and managed by local villagers. Eucalyptus trees are planted in rows, nine meters apart. That leaves four-metre-wide agricultural areas where crops can be planted. The model is based on wide spacing between trees (Figure 8), 9 × 1 meter (1,111 seedlings per hectare). The company

allows farmers to plant crops between the tree rows. The crops are planted and managed until the tree canopy closes. The farmers can usually grow crops during two to three years after planting the trees. The trees need a one-meter buffer zone free from crops on both sides of the tree trunk. The roots have to have two meters of undisturbed soil. Villagers can plant seven meters between the tree rows. After the tree canopy has closed, the cattle can eat grass in the area during four to five years before the trees are harvested. Villagers have access to the taungya agroforestry area the whole renting time, but they cannot cut the trees. Expected rotation period for trees is six to seven years, with expected yield of 24 m^3 per hectare per year.

Figure 8 Yong eucalyptus in Khung Village, Savannakhet Province (Rapid Rural Appraisal)

The company uses mainly former shifting cultivation areas. The taungya system is only applied in areas where the local people are interested in intercropping. When tree plantations are far from villages or on areas where the agriculture is ineffective, wide spacing taungya agroforestry model is not used. Pure eucalyptus stands are established instead using spacing of 3 × 3 meters. More work opportunities are created because the local people are involved in managing the tree plantations. When a new plantation is established and the land is cleared of other vegetation, SE only plants on degraded land that the local people no longer use for agriculture. The

company clears the bush and unexploded bombs[2] from the area where the trees are planted, does soil preparation and planting, weeding and fertilizing activities and harvesting of the eucalyptus and acacia trees.

Depending on soil depth and conditions, the soil preparation is done with harrowing or ripping. Approximately 330 kg Dolomite fertilization per hectare is added before planting, followed by 220 kg one year after the establishment. SE adds about 0.55 tons per hectare fertilizer in total in all tree plantations during one rotation. Weeding is done firstly by hand around the seedlings, at least once a year, and afterwards by machine, as the trees grow bigger.

SE fertilizes the trees of the plantation areas. First this is done before the trees are planted. Stora Enso has all the machines for soil preparation and to transport trees from forest to the factory. Fertilizers are used in the amount of 200g for one tree. Second fertilization time is in the same year. The company uses tractors to spread the material to the area. In the second year, the company uses only one-time fertilizers, same amount as in the year one. The rotation time for eucalyptus is seven years. The diameter of a tree is normally about 18-20 meters and the height is about 18 meters. Trees will be cut down into four-meter length and the company transports them through Ta Oi to Vietnamese market.

The company is promoting the program in the villages and explaining the methods to the villagers. Most important is to find land that is suitable for growing eucalyptus and acacia. In Sepon District, villages must have two kinds of land areas in the village, which will be part of the program; community land and private land, usually 10-150 hectares. In Ta Oi District, the company only rents community land areas. The village normally rents 5% of the total area and does not exceed 500 hectares. The company denied that SE forest contains <30m^3 per hectare of all kind of wood with a diameter of >15cm. The priority is given to land selected by the farmers and that land no longer produces enough rice yield. Land close to roads and housing areas is avoided. Areas should be flat (under 25^o slope). This definition effectively rules out primary and secondary forests.

[2] During the Vietnam War, more than two million tonnes of bombs were dropped over Laos. A lot of those bombs did not explode, making the environment dangerous.

Before the company makes an agreement with the village, it must follow these five steps:

1. ***Village mapping and land use classification***

Village borders are surveyed and mapped in cooperation with surrounding villages and district officials. Spirit forests, protection forests, other forest types, permanent agricultural land and other land of cultural, environmental or historical importance. Interests are described and left out from plantation area. Map with survey report is given to the village and district land.

2. ***SE socioeconomic baseline survey***

Villages in areas designated by the district government were surveyed by a team of members from SE and the district. Information is given about the project. If the village is interested in participating, the socioeconomic survey is executed. If the village is not interested, the team will leave the village and inform district as well as SE project management, and area will not be included in tree plantations.

3. ***Identification of suitable land***

Land suitable for a tree plantation is delineated by satellite images to the village map, showing forest and secondary forest not earlier delineated, slopes over 25^{o}, Protected Forest Areas (PFA), rivers and other restricting terrain features.

4. ***Identification and agreement on available land***

Maps showing suitable land (considering villagers need for agriculture) are presented to villagers and an agreement with village committee is signed on which land the village wants to make available for plantation activities. The total available land is split into six to seven equal parts to cover rotation period of the trees. Area left outside of tree plantations should be minimum one hectare per family per year for seven years' rotation. This will ensure that villagers will have access to sufficient land for traditional shifting cultivation.

5. ***Approval by district and province***

Land use agreements between SE and villages are submitted to each district, where the company operates, for approval. Each district forwards the agreement to Saravan and Savannakhet Province.

Any land purchase conflicts between involved parties: SE, villagers, district and/or province authorities have openly discussed and agreed before plantation work starts. Areas for taungya agroforestry are selected in close cooperation with the villagers and in good time before the traditional agriculture wet season.

The model builds on a wide spacing of trees and allows villagers to grow food and cash crops between the trees and manages plantations on rotations of seven years. Land agreed available for plantation by a village or a cluster of villages is divided into six to seven equal lots to ensure continued work for the villagers during the tree crop rotation. The company provides farmers with rice seeds and other edible crops only for the first year of production for the whole rent period. Each family living in the village has one hectare of farming area per year. Farmers have money for the crop growing as follows: 200,000 kip per hectare. With this money farmers can get 40kg of seeds. The company measures the land area for the farmer to calculate the right amount of seeds. In Sepon area most popular crop is rice, cassava and sweet corn. The company also provides services of agronomist to advise on crop growing and also provides information on markets, particularly price and quantity demands. Tree nurseries are established to support the security of seedlings in the tree plantations. The company has hired employees of certified UXO contractor to clear and burn the land of vegetation, bush clearing, soil preparation and planting. Work includes also plantation maintenance as tree harvesting for processing and sale. Local villagers have a priority to work in most of plantation identification, foundation and management tasks. Villagers are recruited and trained as forestry and nursery workers and they have opportunities for further training and advancement where possible.

Local people who work for the company are paid 40,000 kip per day. The company does not employ people under the age of 15 years old. Normally the working period is in dry season. Some villagers are paid to be security guards for the area. They inform the company if there are any problems or fire in the taungya agroforestry area. A condition of the concession agreement is that the company must pay the Government of Lao PDR a rental fee of 10 USD per hectare every year for the plantation areas. Stora Enso gives villages a Project Fund of 2,800,000 kip per hectare, which can only be used for immediate needs in the village, with a focus on food security, health care, sanitation, income generation activities and education.

Each village decides how the Project Fund will be used. The company rents community land from the villages on 50-year contracts and private land on 30-year contracts. The villages don´t get any cash money from the project.

3.2 *Status and performance of planted trees in taungya agroforestry systems*

Plot location

The results presented here were obtained from taungya agroforestry plantations in Saravan and Savannakhet Provinces (Figure 3). The total area of these two province taungya agroforestry plantations was 788.1 hectares, and the total area of measured taungya plantations was 28.1 hectares.

In total, 28 sample plots were established in taungya agroforestry systems (see Chapter 4.1): 20 of them were in the Saravan Province and eight of them in the Savannakhet Province. Of the measured plots, 26 were planted with eucalyptus, one plot was planted with acacia and one plot was in the trial area where the company had tried several other species. In total, 364 trees were measured in the 28 sample plots.

Plantation establishment, tree health and development

Eucalyptus trees were planted in rows, six meters apart. That allowed four-metre-wide agricultural areas where crops could be planted. The model is based on wide spacing between trees: 9 x 1 meters (1,111 seedlings per hectare). The trees need a one-meter buffer zone free from crops on both sides of the tree trunk. The roots have to have two meters of undisturbed soil. Villagers can plant seven meters between the tree rows.

In the studied systems, the measured total distance between the tree rows was 9.1 meters, and the undisturbed root space 2.5 meters, leaving on the average of 6.6 meters of agricultural area. Average distance of trees in rows was 1.15 meters (Figure 9). Stem volume increased with the tree age and mean individual tree volume was 0.18m^3. The hectare volume was 63m^3 per hectare. Average measured plot surface was 37$m^{2.}$ Average tree diameter was 9.8cm and height was 9.94 meters (1.55-20-meter range).

Figure 9 Tree spacing in Kiengluag Village, Savannakhet Province

Table 3 shows multiple factors that hinder the tree growth. In total, 364 trees were analyzed and measured: 104 trees in the Savannakhet Province and 260 trees in the Saravan Province. In total, 610 observations of damaged trees were made, and 184 trees (51% of all the measured trees) had more than one damage.

The most common damage observed (in 57% of the measured plots) was “ground vegetation”. i.e. the tree stem was surrounded by ground vegetation or climbers covering the stem.

There were 83 stumps in which new coppice (sprouts) were growing. In 85 cases, stems had been damaged in the trunk or in the crown. This indicated that the company had not cleared ground vegetation adequately. This damage was common in the age group of 4-9-year-old trees (Table 4).

Table 3 Number of observed damage to the planted trees. Note: One tree can have more than one damage (data from 364 trees).

	Number of damaged trees		
Damage type	**Savannakhet**	**Saravan**	**Total**
Fire	0	1	1
Fungus	0	3	3
Gound vegetation	39	169	208
Dead tree with coppice regrowth	20	63	83
Stem damage	15	70	85
Insect damage	39	67	106
Climber covering the stem	19	105	124
Total	**132**	**478**	**610**

In total, 106 stems had termite and ants or the stem had suffered from other insect damage. As we can see from Table 4, insect damage was concentrated in the trees aged 4-8 years. Climber plants were in 124 stems. Only one tree had fire damages in the trunk. Three sample trees had unknown fungi in the trunk. At the same sampling plot had most often multiple damage observations, which explains the amount of observations of 610.

Table 4 Tree damage observations in age categories. Note: One tree can have more than one damage (data from 364 trees).

	Tree age							Total
Damage type	**1**	**3**	**4**	**5**	**6**	**8**	**9**	
Fire	0	0	1	0	0	0	0	1
Fungus	0	0	0	0	3	0	0	3
Gound vegetation	0	0	26	52	65	52	13	208
Dead tree with coppice regrowth	10	0	14	22	9	19	9	83
Stem damage	0	0	11	21	47	6	0	85
Insect damage	0	0	13	44	28	21	0	106
Climber covering the stem	26	6	36	22	12	22	0	124
Total	**36**	**6**	**101**	**161**	**164**	**120**	**22**	**610**

Tree growth

As we can see from Figure 10, tree diameter increases as a function of age. Coppice stems caused diameter variation inside of age groups.

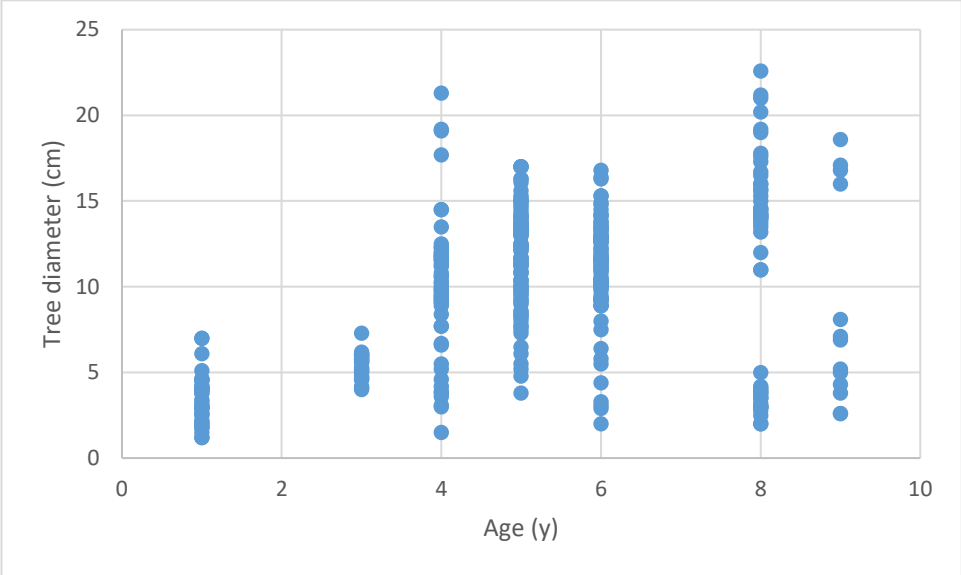


Figure 10 Tree diameter development as a function of age

Tree height increased with the tree age (Figure 11). The plot areas, in which original stem had died and new coppice had regrown, had most variation on height as a function of age. Coppice stems were measured from each plot. In the youngest plots, stem tree height variation was very low.

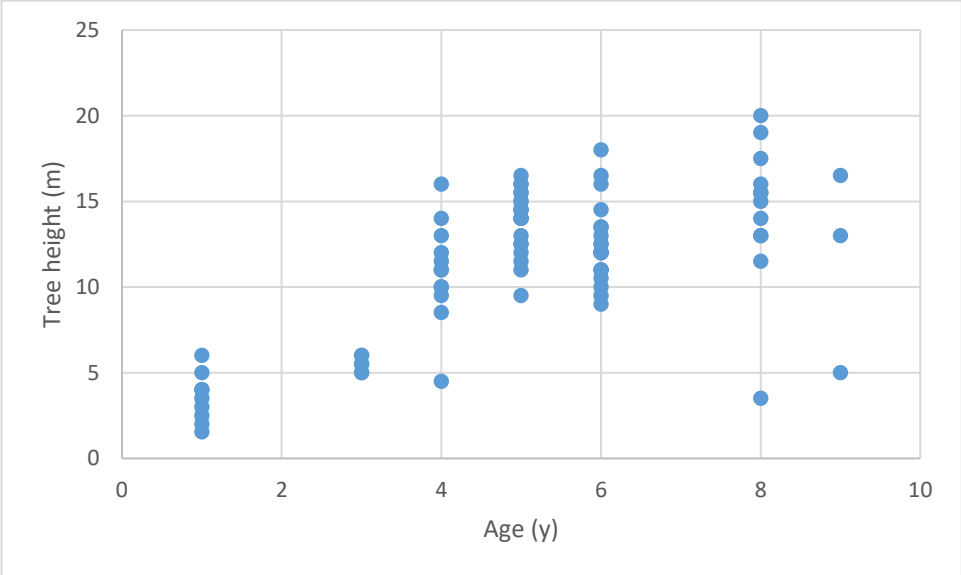


Figure 11 Tree height development as a function of age

As we can see from Figure 12, tree diameter grows simultaneously as the height grows in the plantation area.

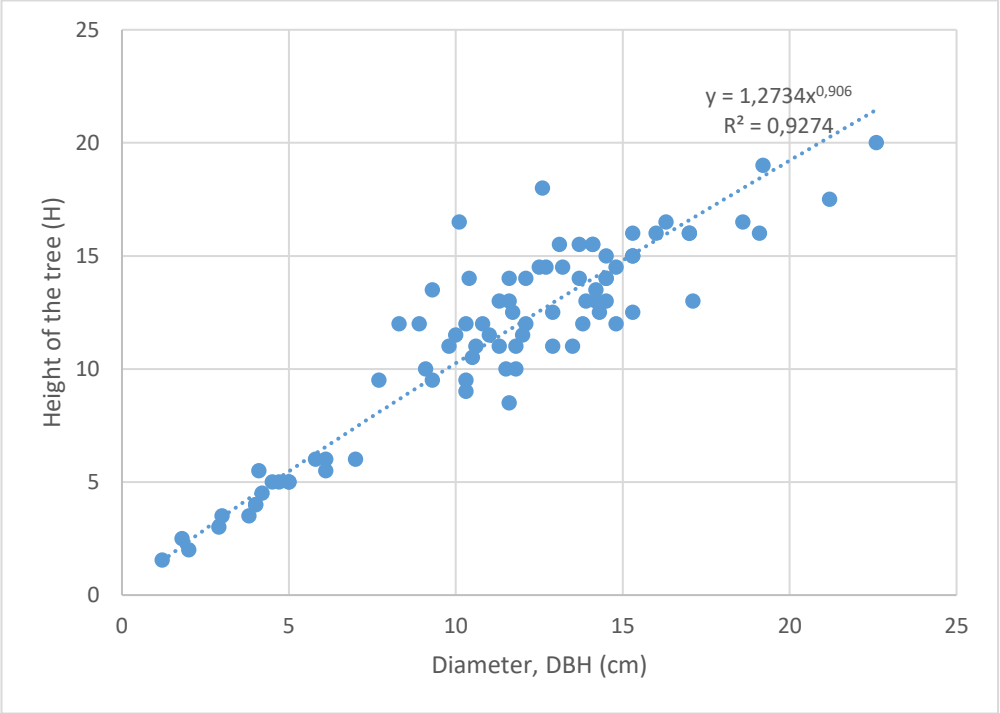


Figure 12 Average diameter (cm) and height (m) of the measured eucalyptus stands

Basal area increased as a function of tree age. As we can see from Figure 13, basal area does not increase multiple times, although the areas have more trees than recommended.

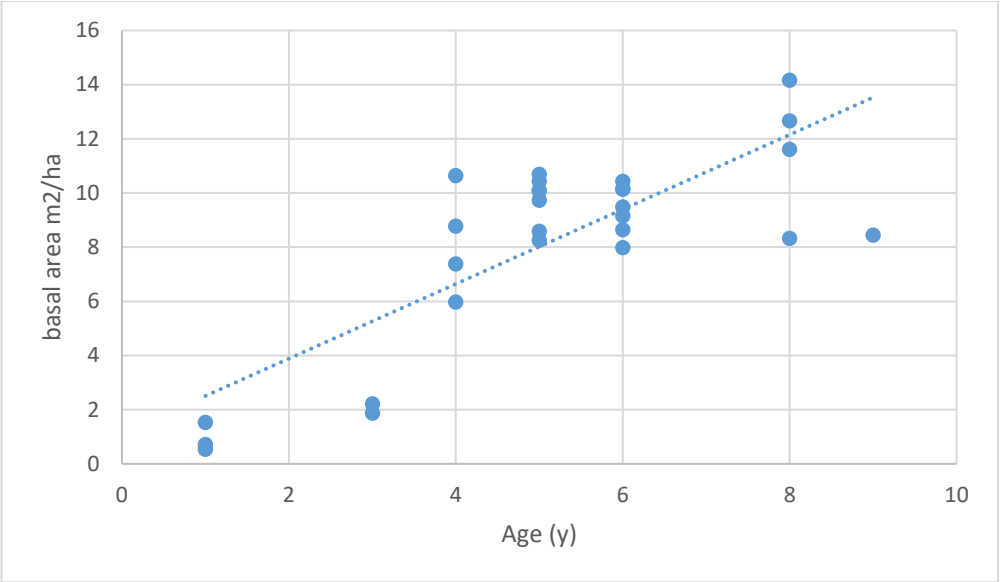


Figure 13 Basal area as a function of age

As we can see from Figure 14, tree volume variates with the age of the plot. Plot age variation was one to nine years. Expected rotation period for trees is six to seven years is 24m^3 per hectare per year. Mean individual tree volume in the measured data was 0.18m^3 and the hectare volume of all trees was 49m^3.

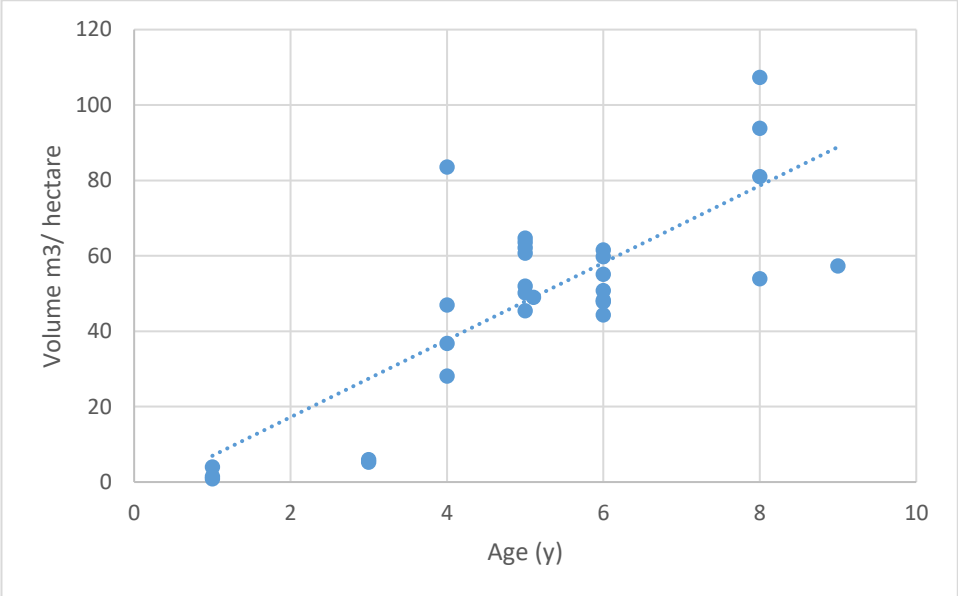


Figure 14 Tree volume as a function of age

3.3 *Impacts on livelihoods*

Village demographics

There were large variations in the population, total land area and rice production in the sample villages. Muangseang, the largest Village, had a population of 1,295 inhabitants, while the smallest Village, Sanya Yon, had a population of 108 inhabitants (Table 5). Sanya Yon had the biggest land area out of all the villages with its 8,631 hectares, while Kacham Village had the smallest land area of 1,190 hectares. Ta Oi was most populous ethnic group of four villages. Other ethnic groups were Phuthai and Katang (Table 5).

Table 5 General village information

Province	**Savannakhet**		**Saravan**			
Village	**Muangchang Village**	**Muangsean Village**	**Lapeung Village**	**Kacham Village**	**Pitiean Village**	**Sanya Yon Village**
No. of households	173	258	44	22	35	18
No. of families	224	181	44	32	35	24
Total population	1069	1295	268	176	253	108
Women (%)	48	47	50	41	51	48
Men (%)	52	53	50	59	49	52
Ethnic group	Ta Oi, Phutai	Phutai	Ta Oi	Katang	Ta Oi	Ta Oi
Total land area (hectares)	1820	4169	1500	1190	2628	8631.3
Total rice production (tons per year)	360.5	5,000	20	22	39	35

Education levels was very low (Figure 15). Figure 13 shows that 42% did not have any education and 47% had only primary school level education. A total of 89% of the villagers had education lower than middle school. Only 2%, which was two people, had high school level education. The low levels of education made it hard to get off-farm jobs.

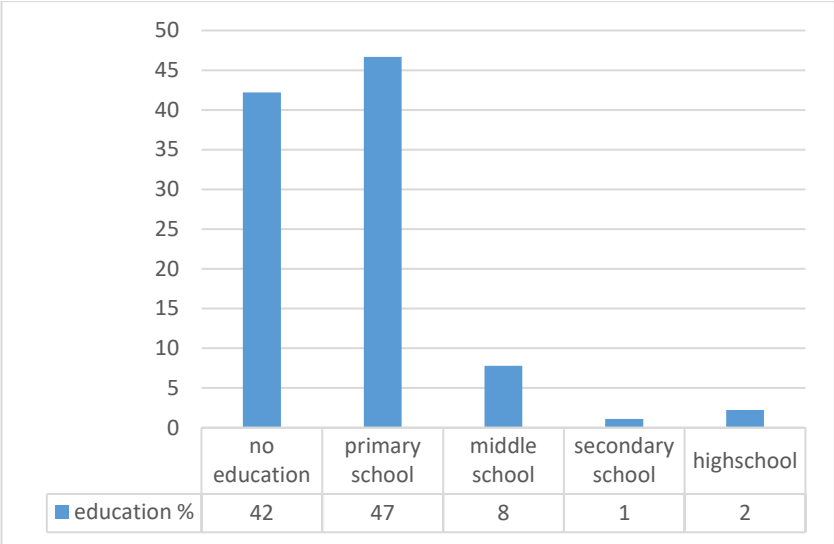


Figure 15 Education at household level

Livelihood strategies and incomes

Most of the village's main income sources came from farming activities (Table 6). Villagers sold livestock, crops and worked in other farms for wages. The main NTFP collected in all villages was bamboo shoots. In all six villages people used to collect bamboo shoots for both subsistence use (food) and for selling (cash). Long distances and lack of vehicles also limited the possibilities to work outside the village and sell products what the villagers had produced in their farms or has made by hand. There were limited possibilities for other businesses in the villages, because villagers did not have enough money to buy anything extra.

Table 6 Main off-farm income sources and NTFP´s of the villages

Village	Main incomes in study villages	Main NTFP´s
Muangchang	labour and sales of cassava	bamboo shoots, vegetables, mushrooms
Muangsean	labour in off-farm	bamboo, wild animals, mushroom
Lapeung	labour for SE, sales of NTFP´s and animals	bamboo shoots, vegetables, mushrooms
Kacham	labour for SE, sales of animals	rattan, vegetables, bamboo shoots
Pitiean	sales of rice, handicraft and NTFP´s	bamboo shoots, rattan, mushrooms
Sanya Yon	labour, sales of NTFP´s and livestock	bamboo, rattan

Figure 16 shows that approximately 43% of the respondents grew crops for a living. 51% grew livestock and crops for living. A total of 94% of the respondents were

primarily farmers, while the remaining 6% were workers outside the village (n=7), teachers (n=2) and shopkeepers (n=1). Villagers earned money by selling handicrafts (n=16), NFTP´s (n=9), cattle (n=2) and fruit (n=2).

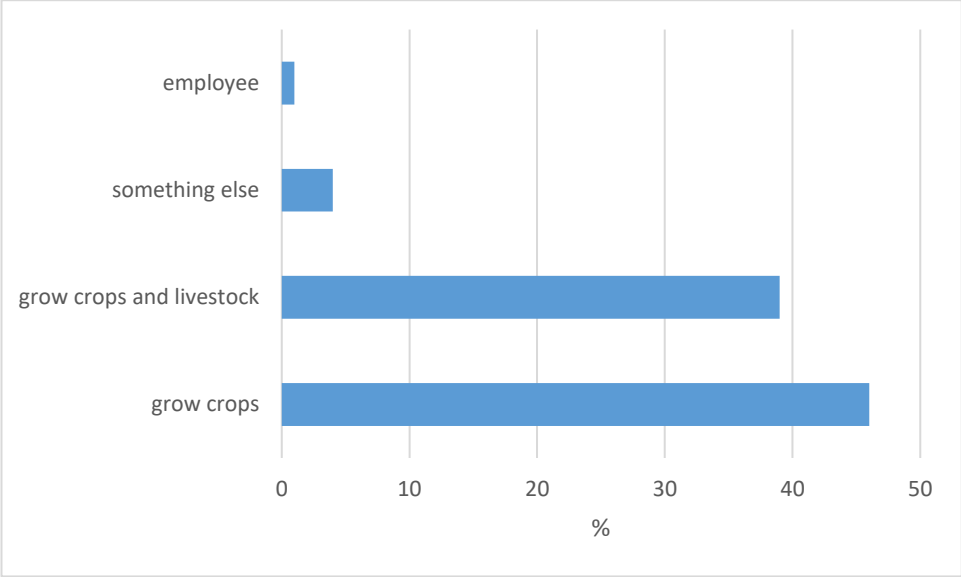


Figure 16 Main livelihood activities (percent of villagers)

The average household had 1.2 hectares of agricultural land and used 42 minutes to walk by foot to their upland rice field. Most of the respondents (68%) answered that they have enough agricultural land, 21% said they had too little land area, and 11% did not respond at all. The average household grew enough rice to feed their families for seven months of the last year. Labour shortage (12%) kept households from producing as much rice as the household needed. Families with small children and old people had challenges to produce enough rice.

From all respondents only 21% of households had part time off-farm incomes such as working on farms outside the village, working on constructions, teaching etc. Part of the villagers (23%) had part time incomes from handcraft and hunted animal sales, 37% of households received income from livestock sales and only 10% received income from the sale of NTFP´s. As we can see from Figure 17, most of the NTFPs and crops went directly to household subsistence use. Muangcahng and Muangseang Villages had the opportunity to sell cassava (16% of all respondents) and only Muangchang Village had the opportunity to sell spare rice (2% of all respondents).

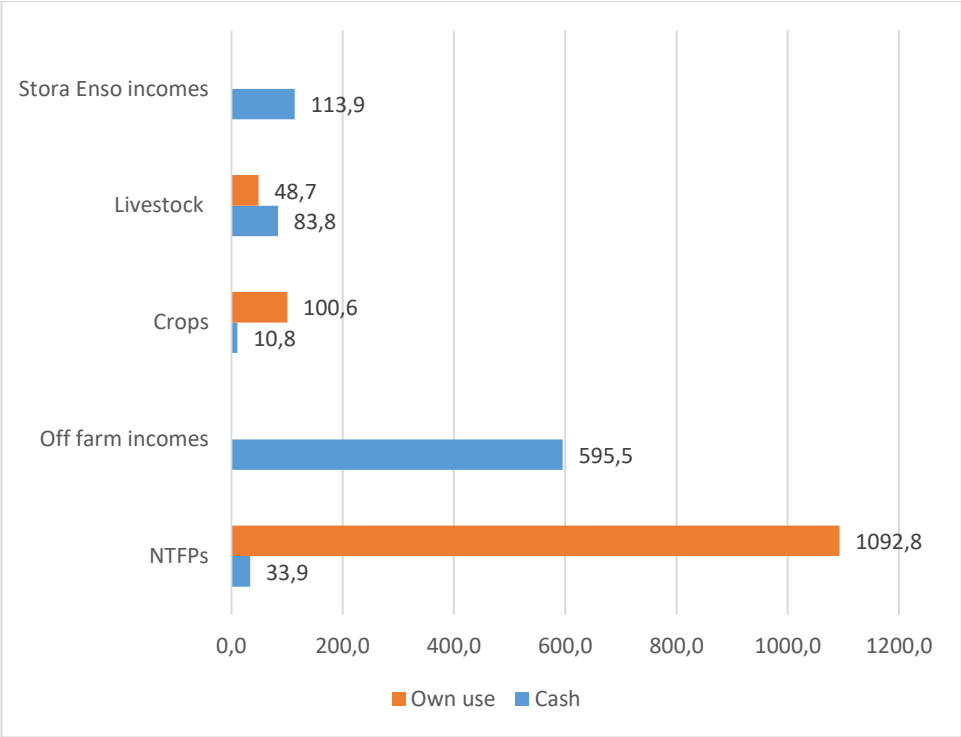


Figure 17 Annual average household income and products for own use.

US Dollar (USD) exchange rate to Lao kip (LAK) 1 USD = 8432 LAK.

Crop Yield

The main crop, upland rice, was used primarily for own consumption (food). Most of the households had only one rice yield per year. Only a few households had the opportunity to grow rice in paddies and had multiple harvests per year. Almost all households (96%) could report their crop production amounts with confidence (Table 7). Households produced 1,458kg of rice for own use on average, but there was a large range of rice production in the households: between 80-7,200kg. In some households, the rice yield was not enough for the whole year´s consumption needs. The average rice yield was enough only for seven months. Villagers collected NTFP´s to get more nutrition next to rice. Households had home gardens where they used to grow other crops and vegetables such as maize, cucumbers, pumpkins, bananas, vegetables etc. for household consumption.

Table 7 Annual cash incomes of a mean household

Annual income sources	Own use (USD)	Households involved %	Cash (USD)	Households involved %
NTFP	1092.8	93	33.9	9
Livestock	48,7	90	48.7	22
Cassava	37	36	599	19
Rice	27	100	4.7	2
TOTAL	1,205.5		686.3	

US Dollar (USD) exchange rate to Lao kip (LAK) 1 USD$ = 8432 LAK

Rice production variety was large. As we can see from Figure 18, Lapeung Village produced less rice, only for food purposes, when Muangchang Village had multiple times more production and cash incomes.

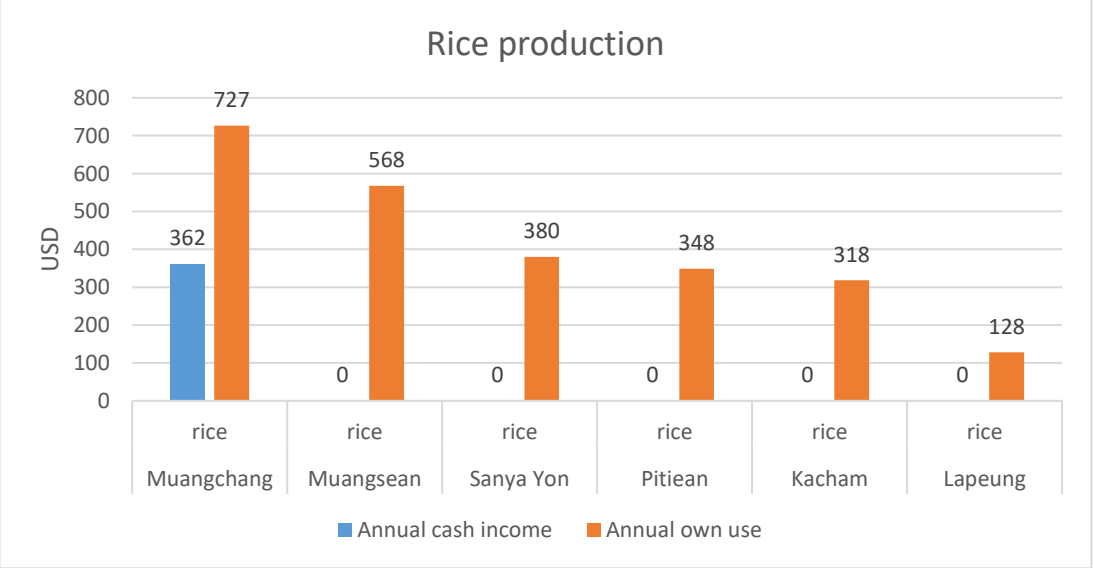


Figure 18 Mean household rice production in the villages

US Dollar (USD) exchange rate to Lao kip (LAK) 1 USD = 8432 LAK.

In addition to rice, households cultivated in home gardens cassava, vegetables, maize, banana and other fruits for own use, and the households did not keep records of the production. Only two villages produced cassava for cash purposes: Muangchan and Muangseang Villages. There was a cassava factory near the villages and there used to be good market for the crop. The problem was that there was over production and the

price on cassava had collapsed. In Ta Oi District there were no markets for cassava and households did not grow the crops for cash purposes. These crops had been cultivated in shifting cultivation areas.

The average household had nine chickens, six goats and four cows. Young livestock were mainly sold when the family needed money, for sacrificing to the spirits or for extra food when the people were working extra hard. Most of the villagers did not keep records of the livestock they were breading.

3.4 *Taungya agroforestry systems in plantation areas*

Plantation usage

Five out of six villages had taungya agroforestry plantations in their village areas. On average, 53% of households in the study villages had used the taungya agroforestry areas to grow crops at some point in time. Only in Lapeung Village all the households (100%) had used the plantation taungya agroforestry area for crops at the same time.

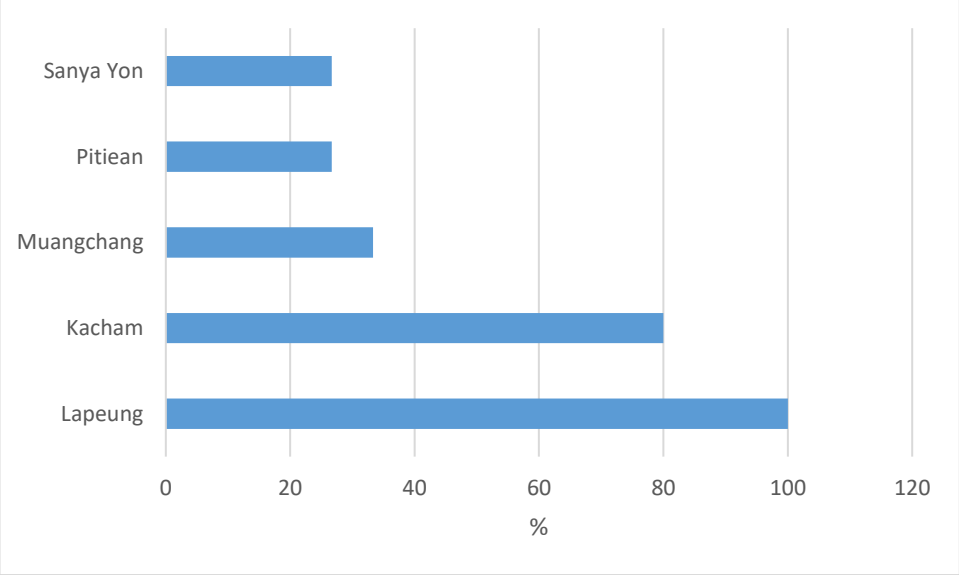


Figure 19 Taungya agroforestry area usage percentage

Sanya Yon had the smallest village population, and almost all (83%) the households were interviewed in the village. On average, only 53% of the households had used the plantation areas for crops. The main reason not to use the area in Pitiean Village was the location of the village. Villages located far away from the market place had

limited possibilities to sell surplus crop production. Pitiean had also very low plantation usage for crops (27%) by the villagers. The village had recently moved near the main road. Many respondents from Pitiean reported that the taungya plantation area was too far from the village. *"It takes two to three hours to walk to the plantation area - do not want to use the area."* The village had only one motor vehicle and the villagers had to walk to the area by foot hours per day, if they wanted to use the area.

Figure 20 shows the reasons why villagers from all villages did not want to use their plantation areas, which include:

- shading of the trees inhibits crop growth (18% of the respondents)
- lack of available labour (18%)
- plantation area too far (16%)
- could not use the area because the family had recently moved into the village or was relatively new (14%)
- did not believe in the system (8%)
- did not use the area because there was no fence and free livestock ate all the yield (8%)
- believed that the land did not have enough nutrients (6%)
- did not believe that the yield was good (4%)
- had enough land and rice so did not want to do more work (4%)
- did not want to do extra work (2%)

When the respondents were asked to consider the benefits of the area, answers were: good soil preparation (24%) and good crop yield (76%). *"The plantation area is a better place to grow crops than paddy or shifting cultivation area because the soil is soft and mixed. I would like to get more education on how to grow other crops than rice."*

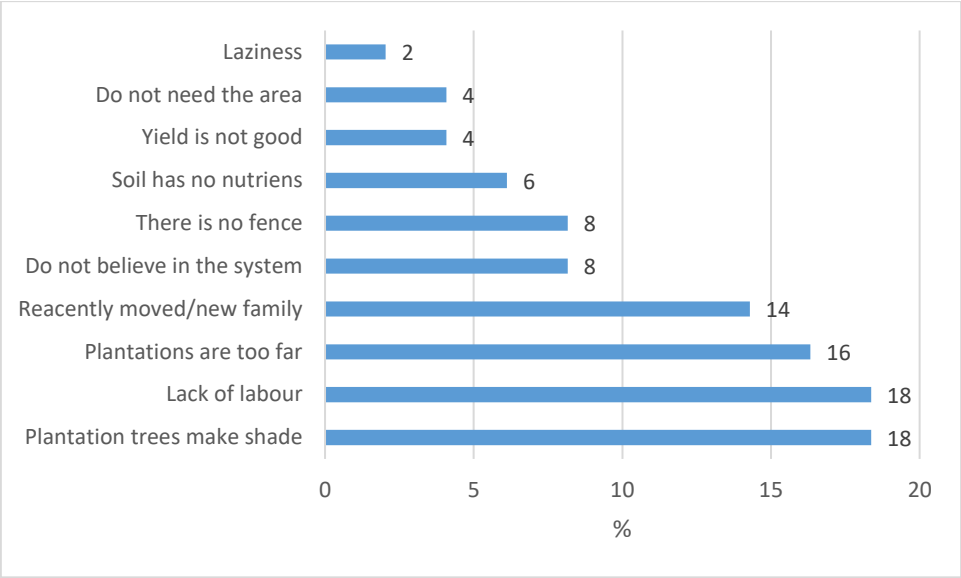


Figure 20 Why locals did not use the plantation area for food production (n=49)

Plantation-related activies

As we can see from Figure 21, the most common tasks for villagers employed by Stora Enso were weed clearing (n=77), tree planting (n=75) and land clearing. Only few respondents were plantation guards (n=9) or were involved with the harvesting (n=12) for the company. The average family worked 24 days for the company in the beginning of the village program, with a wage of 40,000 kip per day (4.7 USD), for a total annual income of 960,000 kip (113.9 USD).

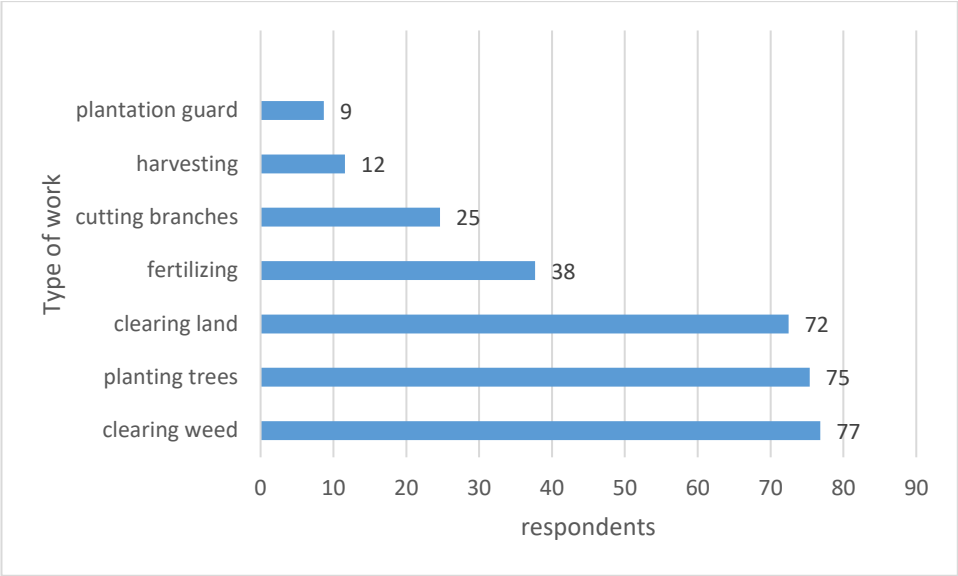


Figure 21 Work tasks for Stora Enso (% of respondents)

Villagers were provided with free seeds from the company in the start year of SEVP. Only 36% of the respondents remembered receiving money or seeds from the company in the first year. Villagers estimated an average of 0.9 hectares of land to grow crops in the plantation area, where the company aims minimum of 1 hectare per family. Most of the households, 92% of the respondents had worked for the company. An average of two people per household worked for the company for 24 days. The most common type of work was clearing weeds, planting seedlings and clearing land.

Table 8 Mean of all household's activities with Stora Enso

Received seeds from the company	36	%
Worked for the company	92	%
No. of persons/household worked for the company	2	persons
No. of days household worked for the company	24	days
Time to walk to the rice field	42	minutes

When the villagers were asked if they would like to grow other crops than rice in the field area, 32% of the respondents answered yes.

The villagers had noticed some positive and some negative environmental changes near the plantations, with 38% reporting that they noticed changes such as reduced

water level in the rivers nearby. Concerns about the fertilizers that the company uses and fear of the associated water quality changes were also cited. Positive changes were new edible mushroom species in the plantation areas.

4 DISCUSSION

4.1 *Performance and growth of the tree plantations*

Tree plantations are frequently described as high density monocultures of on-native species, established to reduce the exploitation of natural forests and to satisfy increasing demands for forest products (Chazedon et al., 2016; DÁmato et al., 2017a; Pirarard et al., 2016a; Malkamäki et al., 2018). In the trial areas, the company had tried to plant small areas of different tree species such as teak and mahogany.

In general, the tree plantations were in good condition. However, the ground vegetation and climbers caused harm for stem growth in 57% of the measured plots (Table 3, Page 29). Later, there were less damage when the trees were older and stems significantly higher than the ground vegetation (Table 4, Page 29). Thus, more attention has to be paid to the control of ground vegetation and climbers in young plantations. In Sepon District plantation areas were relatively new if you compare the plots in to the Ta Oi District area plots.

Most of the plantation plots did not have any fences around the plantation area allowing free access to the area for cattle. Cattle damaged the young plantation stands by eating the trees and planted crops (Table 3). Other factors causing damage to the trees were human logging activity, injuries in the tree trunk, severe wind and storm and forest fire (Figure 24).

Plantation age range was one to nine years, thus the company had periods when the clearcutting was not possible to implement. Logging prohibition was caused by the government legislation, which kept the company from selling trees outside Lao PDR. This prohibition increased the age of few plantation areas.

Figure 22 Taungya agroforestry system used in the study area (photo from Muangchang Village, Savannakhet Province). Fire damage can be seen in the plantation area. Fire from nearby shifting cultivation caused heat damage to the eucalyptus trees.

Tree diameter growth (Figure 10) had multiple variation inside age groups, especially in the age range of four to nine years. Poor growth and diameter variation may be caused by dead individuals and coppice (caused by cattle), damaged and dead trees due to ground vegetation, high tree density (no thinning was done in the area and tree distance in rows was 1.15 meters), poor site conditions (despite the fact that the company fertilized the areas) or a combination of all of these.

Tree height varied greatly inside of age groups due to new coppices (Figure 11). The average age was five years (range between one to nine years). The average total height in the plantations was 9.94 meters (1.55-20 meter range). Lumbers et al. (2018) reported plantation height-age growth modes with *Acacia mangium* and *Eucalyptus pellita* stands in Pangkalan Bun, Central Kalimantan, Indonesia. Lumbers et al. (2018) reported the average age of *Eucalyptus pellita* as five years (range between one to nine years) and the average total dominant height as 22 meters (6.3-32.2-meter range). Stora Enso uses clone eucalyptus between *Eucalyptus camalduelensis* and *Eucalyptus deglupta* in the majority of plantations, why there was limited possibilities to find parallel research for the tree species. After comparing Lumbers et al. (2018) with the present study, it was observed that the present study provides a lower prediction of height growth. Disparity in the height growth can be assigned to the poor site quality in Laos and variations in the site type.

Basal area did not increase multiple times during age development (Figure 13). Alternatives to basal area differences inside age groups may be a result of the loss of trees in different age stages such as dead individuals and coppice (caused by cattle, human activity, ground vegetation, insects or other damages which had led to the death of trees) or poor site conditions.

Tree volume growth (Figure 14) did not increase linearly with the age of trees. Measured sites had uneven sized trees, while there were large variations in the tree volume in the same aged plots. Alternatives to tree volume growth differences may have been caused by dead individuals and coppice (caused by cattle, human activity, ground vegetation, insects or other damages that led to the death of trees), poor site conditions or a combination of all these.

4.2 *Households and livelihood*

Zhou (2012) reported poor infrastructure connecting Stora Enso village program villages to markets limited capabilities to make use of any increased yields from the taungya agroforestry systems for cash income, with any surplus of crops sold to purchase additional food suppliers. According to the present study, most of the households in the villages had farming as their main income source. Long distances and lack of vehicles limited the possibilities to work outside the village and sell products that the villagers had produced in their farms or made by hand. The results of this study show that out of all respondents only 21% of households had off-farm incomes, 37% of households received income from livestock sales and only 10% received income from the sale of NTFP´s. Most of the NTFPs, crops and livestock went directly to the daily use of households. Muangcahng and Muangseang villages had the opportunity to sell cassava (16% of all respondents) and only Muangchang village had the opportunity to sell surplus rice (2% of all respondents), due to better access to markets. The results of this study highlight the effect of village location on household incomes. Village location and market connections are in a key role of village income development.

IUCN (2008) collected data on rice sufficiency of Lao PRD. The average rice sufficiency of Sepon District households recorded only six months of one year (Salwood, 2008). The average household of all respondents of Sepon and Ta Oi had enough rice to feed their families for seven months of the past year. The results of this research show that the rice sufficiency of the area had increased in ten years.

Axselsson and Svensson (2007) reported Savannakhet Province, Nong and Sepon District total annual cash incomes for villages ranging between 508 USD to 2,380 USD. The average income for a household in the survey was 33.50 USD, which is extremely low. Main sources of income came from NTFPs, domestic animals, crops, sale of rice, labour and scrap metal (Axelsson and Svensson, 2007). The present study shows reported Savannakhet and Saravan Provinces, Sepon and Ta Oi District total annual cash income for SEVP villages ranging between 752.5 UDS (Lapeung Village) to 23,534 UDS (Muangsean Village) with total annual cash income for household being 763,7 UDS. This research shows that villages´ income level has increased in ten years and in addition the value of the kip currency and the price level have also changed over the years. A decade later the main sources of income came from off-farm incomes, livestock and NTFP´s.

4.3 *Taungya usage*

Villagers were happy for new income possibilities, and benefitted from the soil preparation and increased crop yields from the taungya agroforestry areas. Some examples of positive impacts related to changes in livelihood activities made possible by plantation establishment, for example improved conditions for beekeeping on eucalyptus plantations in Uruguay (Malkamäki et al., 2018; Malkämäki et al., 2016), and enhanced agricultural production in Laos tracking the introduction of intercropping between rows of planted plantation trees (Malkamäki et al., 2018; Leval and Prejer, 2013). It is noted that there is risk of local communities losing their self-determination. In Argentina, the free sales and collection of highly considered mushrooms rich in pine plantations of private landowners provided a supplementary income source for particular women and poorest households, although the share of the new income to overall livelihood circumstances stays unclear (Malkamäki et al., 2018; Fernández et al., 2012).

The results of this study show villagers who used intercropping possibility in the plantation area were mainly pleased by the area, and one third of the villagers were eager to explore new forms of production (Figure 23). It appears that intercropping and beekeeping on plantations had become more common recently. Combined plantation intercropping and wage employment could improve the complementarity facility of plantations in helping local people to overcome seasonal income variation (Malkamäki et al., 2018)

The taungya system is only applied in areas where the local people are interested in intercropping, just over half (53%) of the households in the sample villages had used the plantation area to grow crops at some point in time. Reasons why villagers did not want to use the area were, such as shade of the trees inhibits crop growth, lack of labour or that plantation area was located too far from home. Villagers who complained about tree shade may not have understood the plantation rotation system whereby the area for rice cultivation is limited to a maximum of two or three years, until the tree canopy closes. Some respondents had prejudice against the taungya system, e.g., they thought that the yield is not good or nutrients were low in the area, and also people did not believe in the system. According to Malkamäki et al., (2018) tree plantations rarely dominate the most fertile soils suited for agriculture.

Figure 23 Pineapple trial between eucalyptus rows in Pitiean Village, Saravan Province

First research question of the study was: What kind of incomes do the local families get? The results show that 92% of the respondent households worked for the company, usually in the start phase of the village program, and were paid 40,000 kip per day. An average family got 960,000 kip / 114 USD in the start phase of the village program by working for Stora Enso. Wage incomes from working for SE were relatively small compared to the income from collection of NTFP´s and rice that the households produce and collect yearly for their own use. Different work tasks focus mainly on the first years of plantation rotation and villagers were eager to

get more work opportunities: "*There is too little work, I would like to work more*." According to the villagers, the need for the workforce changed during the seasons.

In the global review, Malkamäki et al. (2018) reported that the plantation jobs were often part-time, temporary or both. One case-study example of a corporate-owned eucalyptus plantation in Uruguay generate uncertain employment, and one of the reasons relies with the responsibility of contractors, who do not have standards for contracts and wages in place (Malkamäki et al., 2018; Carámbula and Piñeiro, 2006). Nevertheless, with more people working in the area, the sector offers more jobs compared to the areas where livelihood activities are small-scale agriculture activities or cattle grazing (Malkamäki et al., 2018; Carámbula and Piñeiro, 2006). Work on large scale tree plantations are often uncertain and seasonal, and tend to become available only during tree planting or land clearing (Malkamäki et al., 2018; Deininger et al., 2011b; Hunsberger et al., 2017; Pirard and Mayer, 2009). The results of this study are similar to Malkamäki et al. (2018) report: the company provides new, temporary income opportunities for five study villages. Work opportunities for the villagers are mainly seasonal and jobs are available mainly during land clearing and tree planting, which poses negative challenges for economic planning, but brings possibilities to the villagers to earn extra money. The respondents of this study have standard wages working for Stora Enso, thus people would like to raise their daily wage.

4.4 *Pros and cons of the Stora Enso Village Program*

One of the positive impacts of the SEVP is that the company clears unexploded bombs from the plantation area, and that villagers can do safe farming in the planted area. Villages can choose where they want to invest the village fund money from the company, e.g., for infrastructure, building or renovating the village school, buying livestock for the village etc. However, a bad investment decision of the village, such as large number of animals that die early, may provide limited benefits.

Interviews with local authorities revealed that they are concerned about the future impacts of large scale plantations, if the villages have too large areas in rental usage. This research shows that local peoples´ livelihoods are still highly dependent on crop production and NTFP collection. Income from the SEVP work is not enough to provide villagers livelihood without agriculture.

The full potential of agroforestry is not fully utilized in the current system. It could be improved through the plantation rotation, by shade tolerant crops, shrubs etc., and in the start phase with better utilization. According to this research 47% of the responders did not use the area in the start phase. The villagers who were eager to earn extra incomes could grow shade tolerant species, if there would be better access to the market.

Overall the model of SEVP is a step in the right direction for large scale tree plantation development and there were no observations about negative attitudes during the field work. Acceptance of local communities for large scale tree plantations is in the key role when working in rural areas. According to the company, tree plantations influence local land use, and therefore ecosystems and livelihoods and socio-environmental impacts must be managed responsibly to maintain cooperative community relations, and to maximize their positive influence and ensure long term ‘social license’ to operate (Stora Enso, 2019).

4.5 *Limitations of the study*

Lack of data

There was very little previous research and knowledge available from the area and Laos. The company had collected some previous data of the villages in the beginning of the village programs, where few research villages were part of. Developing country had low digital information system that outsiders could use to research or for other actions. The basic data needed in almost all parts was collected by hand in the villages. Because of the lack of work opportunities, there were almost no cash incomes in the households and the cash flow could only be measured by food production and NTFP´s.

Language barrier

Language barrier caused small challenges to the research and interviews. It took a lot of time to translate long sentences between the villagers and the translator. Sometimes the respondents looked little impatient because the translation time took quite some time. In the villages, where people did not understand Lao language, interviews took double the time because of the double translation. There was a risk that the statement of the respondent changed some during the translation. If the respondent had big lack of knowledge, there were challenges to get any information at all, because numbers, amounts and other attributes were challenging to estimate. Most of the household respondents did not add much own information to the answers and answered mainly to the asked question.

Lack of education

In interviews villagers had challenges to estimate amounts, distances and crop yield. In the focus group discussions, villagers who did not know how to read, write or draw, had challenges to locate their household on the map.

In Focus Group Discussions villagers were asked to draw a map of the village to show the houses of the village on map. In many women´s groups women could not participate because they did not know how to draw with pencil. The first idea was that the villagers could help us by writing the main incomes on a paper. In the end the translator had to write, because most of the people did not know how to write.

In the household interviews it was challenging to collect data on distances, amounts and other attributes. People who did not have education at all or the education level was low, could not read or write properly. Especially young women had biggest challenges to estimate incomes and production of farms. Women's education level was lower than that of men.

4.6 *Proposals for the future development of SEVP*

Plantation and village management

Plantation management could be improved with digital forest management software where all updated data is available to the staff involved in planning and management of the plantations. Digital forest management software may help with designing future harvesting, making comprehensive reports on tree volume, forecasting forest development and updating tree data. Employees could update the latest tree data to the system during field inspections. Village information and other vital data could be collected for customer relationship management program or such other system where current and updated data is available for the employees.

During the fieldwork, there did not appear to be any systematic monitoring or inventory of plantations by the company. Systematic plantation development with digital forest management software would help the company monitor and maintain the plantation areas and plantation performance in best condition. These could be inventories/monitoring of tree survival and silvicultural conditions.

The potential of agroforestry is not fully utilized through the plantation rotation. The farmers usually only grow the crops within the first years after planting the trees, and following which the area between the rows is left empty. Shade tolerant crops or shrubs may be alternative options in years when rice is not grown in the area. One third of the farmers were interested in alternative crop options. The row area allocated to each family is too small to allow a proper rotation system to be established. Larger plantation land areas in different rotation periods would provide steadier income for local people.

Incomes

The villagers were eager to get more income. There were lack of labour and knowledge and no access to market. Mushrooms seemed to grow easily in the plantation areas and it would not need as much labour as crop growing by hand. Therefore, mushroom production or other species which do not require constant labour in the plantation area could be one solution to get more food and incomes when the canopy of the trees has closed and there is less light available.

Lack of market was a problem for the villagers. If there is no market available, how can the locals sell products that they produce? With better opportunities to sell produced products, the villagers could produce more products to take to market.

One third of the villagers were eager to learn new forms of cultivation but they lacked the knowledge of growing new plants to supply market demands. Most of the respondents, who were not willing to try new food production ways, were complaining about the bad market situation. The villagers could be motivated to produce more products for sale if there were more opportunities to sell products.

Cattle fencing

According to local people and the staff of Stora Enso, free-ranging cattle caused large damages to the trees and crop production. To prevent future crop and tree damages, an alternative option could be to close the cattle in to stockyards or fence all the new plantation areas until the tree canopy has closed in the agroforestry sites. Cattle fencing may require adoption of new lifestyle.

Work opportunities

Villagers were eager to have more work in the plantation areas. Higher age distribution of the plantations would give more steady income and taungya agroforestry possibilities, when new seedling stands would be established every other year. The company would need more land areas from villages to develop age variation, therefore government is in key role of developing the system.

Future research

Even though this research was done in a small area of Laos, it gave some direction of the total outcome of the country´s data situation. There was quite little research done

in the rural area of Laos. All the new data is good for the development of Lao PDR. One of the main issues of searching data was that there was limited amount of data available in electronic form and in English. If researchers outside the country would like to pursue previous studies, digital research material would be an excellent aid.

The finding of the household interviews was that the people would like to find more employment outside the villages or inside the villages. New research could find new possibilities for the rural people to find new ways to earn money.

5 CONCLUSIONS

The key findings of this thesis highlight the importance of extra incomes for the villagers by working for Stora Enso. The results of the study show that the families have new job opportunities. New job opportunities in the village made it possible for families to have incomes that were not possible previously.

The majority of company-related wage income and crop yields from the plantation rows focus on the first one to three years of the plantation cycle. Working opportunities and crop production between the tree rows were limited after the plantation trees got older and bigger. The company had to offer only seasonal work in the start phase, which means that employees are over-supplied. Villages with larger land areas in different rotation periods would have the steadiest incomes from the tree plantations and continuous tree cultivation and production for the company. All the parties are not willing to give large areas to SEVP usage, because there are concerns of the availability of farmland for food security. Larger land area rental agreements would require new way of thinking of the policy-makers in Laos.

There were differences between the villages due to their location. Villages, that were close to main roads and with markets more accessible, had better possibilities for cash crop production. Also lack of machines and big distances to the rice fields led to a bigger gap between villages´ crop production. In most of the villages there were no available markets for selling surplus production. Most of the households produced food only for their own consumption. If a household had the opportunity to produce extra yield, it did not want to grow more food than what it needed, since there was no market or spare labour available. Limited knowledge of non-rice crop production kept local people from cultivating other products to the market. There is also a need

for attitude and cultural change in the locals to start cultivating other commercial products. Nevertheless the income level of the villages has increased over the years.

SEVP is a good concept as a village development program, which brings work opportunities to the local people and helps villages to build infrastructure and raise education level. The concept could be replicated to other developing countries; but it should always be adapted to the local community conditions, according to local needs. Most wood producing companies in the world do not try to develop local communities and produce food in the plantation area. Many of the villages had used the village fund money to build schools to the village so that every family had the opportunity to educate their children. Infrastructural improvements will help to develop this rural area in long term.

The main challenge in the current taungya agroforestry system is small amount of plantation areas, which make crop rotation impossible for the villagers. Company's limited land use agreements also keep the households from having larger crop rotation rows. The potential of agroforestry is not fully utilized through the plantation rotation by shade tolerant crops, shrubs etc.

Overall the villagers were pleased with the land preparation and the crop yield in plantation area. Lack of labour, shading of the plantation trees and long distances to the plantation area were the bigger reasons why villagers did not use the plantation areas for crop production. Cash crop production and sales of surplus was difficult in the villages which were located far away from the market. Nevertheless, crop production and collection of NTFP´s had high importance for the villagers during the research and in the future. There is a need for future research of households farming importance meanwhile the Lao PRD and local people livelihood develops.

6 REFERENCES

Arvola, A., Anttila, J-P., Hogarth, N. 2018. By accident or by design? Influence of government policies on drivers and barriers and barriers of smallholder teak growing in Lao PDR, Forests, Trees and Livelihoods. Department of Forest Sciences, Viikki Topical Insitute (VITRI). University of Helsinki, Finland.

Atangana, A., Khasa, D., Chang, S., Degrande, A. 2013. Tropical Agroforestry. Springer, Dordrecht Heidelberg London New York. 380 p.

Axelsson, H., Svensson, P. 2007. Cash Income Baseline Survey - Nong and Sepon District, Savannakhet Province, Lao PDR. Burapha Agroforestry Ltd.

Axelsson, H., Svensson, P. 2007. Socio Economic Baseline Survey, Salavan Province. Ta Oi District.

Barney, K., Van Deer Meer Simo, A. 2019. Forest Plantations and Smallholder Livelihoods: Evidence from Community Case Studies in Lao PDR. Project working paper. ACIAR Project FST, 2014: Improving policies for forest plantations to balance smallholder, industry and environmental needs.

BBC. 2016. Laos profile – timeline. [referred to 8.7.2016]. Available at: https://www.bbc.com/news/world-asia-pacific-15355605

BSR. 2014. Natour, F. Edinger L., Nestor P., Fresia P, Stora Enso Laos (SEL) Human Rights Impact Assessment

Burapha. 2019. [referred to 15.3.2019]. Available at: http://www.buraphawood.com/home/about-us/company/

CIA. 2016. [referred to 5.12.2017]. Available at: https://www.cia.gov/library/publications/the-world-factbook/geos/la.html

Charoenwatana, T. and Rambo, A. T. 1991. Swidden agroecosystems in Sepone district, Savannakhet Province, Lao PDR. 141pp. Khon Kaen, SUAN Regional Secretariat.

Dorward A., Macartney J. 2015. Unit 1: Rural Livelihoods: Importance and Definition. SOAS University of London. Retrieved 03 December 2015. [referred to 29.10.2017]. Available at: http://www.soas.ac.uk/cedep-demos/000_P535_SRL_K3736-Demo/module/pdfs/p535_unit_01.pdf

IFAD. 2011. Rural Poverty Report 2011. Retrieved 03 December 2015. [referred to 5.12.2017]. Available at: http://www.ifad.org/rpr2011/report/e/overview.pdf

Günter S., Weber M., Stimm B,. Mosandl R. 2011. Silviculture in the tropics. Tropical forestry series. Springer

IUCN International Union for Conservation of Nature and Natural Recourses. 2008. A Rapid Participatory Biodiversity Assessment of Stora Enso Eucalypt Plantation in Southern Lao PDR

Jonsson, K. 1995. Agroforestry in Dry Savanna Areas in Africa: Interactions Between Trees, Soils and Crops. Dissertation, Umeå.

Lavrakas, P. 2008. Encyclopedia of Survey Research Methods.

Lestrelin, G., Trockenbrodt, M., Phanvilay, K., Thongmanivong, S., Vongvisouk, T., Thuy, P. T., & Castella, J. C. 2013. The context of REDD+ in the Lao People's Democratic Republic: Drivers, agents and institutions (Vol. 92). CIFOR.

Locatelli, B., Kanninen, M., Brockhaus, M., Pierce Colfer, C.J., Murdiyarso, D. & Santoso, H. 2008. Facing an Uncertain Future? How forests and people can adapt to climate change. CIFOR. 86 p. ISBN 978-979-1412-75-9.

Lumbres, R.I.C., Seo, Y.O., Son, Y.M., Doyog, N.D., Lee, Y.J. 2018. Height-age model and site index curves for Acacia mangium and Eucalyptus pellita in Indonesia. Forest Science and Technology 14, 91-96.

MacDicken, K. G., Vergara, N. T. 1990. Agroforestry: Classification and Management. John Wiley & Sons, Inc., USA.

Malkamäki A., D'Amato D., Hogarth NJ., Kanninen M., Pirard R., Toppinen A. and Zhou W. 2018. A systematic review of the socio-economic impacts of large-scale tree plantations, worldwide. Global Environmental Change 53, 90-103. ELSEVIER.

Malkamäki A. et al. 2016. Impacts of land use and land use changes on the resilience of beekeeping in Uruguay. Forest Policy and Economics 70: 113–23.

Malkamäki A., D'Amato D., Hogarth NJ., Kanninen M., Pirard R., Toppinen A. and Zhou W. 2017. The socioeconomic impacts of large-scale tree plantations on local

communities: A systematic review protocol. Working Paper 222. Bogor, Indonesia: CIFOR.

Manfre, C., & Rubin, D. 2012. Integrating gender into forestry research: A guide for CIFOR scientists and program administrators. CIFOR.

OECD. 2014. Country Note Extract from the Economic Outlook for Southeast Asia, China and India: Beyond the Middle-Income Trap. [referred to 10.11.2017]. Available at: https://www.oecd-ilibrary.org/development/economic-outlook-for-southeast-asia-china-and-india-2014_saeo-2014-en

Pachas N., Sakanphet S., Saukkhy O., Lao M., Savathvong S., Newby J. C., Souliyasack., Keoboualapha B., Dieters M. J. 2019. Initial spacing of teak (Tectona grandis) in northern Lao PDR: Impacts on the growth of teak and companion crops. Forest Ecology and Management 435, 77-88. ELSEVIER.

Palm C. A. 2005. Alternatives to Slash and Burn (Programme)

Payn, T., Carnus, J.M., Freer-Smith, P., Kimberley, M., Kollert, W., Liu, S., Wingfield, M.J. 2015. Changes in planted forests and future global implications. For. Ecol. Manage. 352, 57–67.

Salwood Asia Pacific Pty Ltd, Enviromental Impact Assessment. 2008. Commercial Plantations in Savannakhet and Saravanh Provinces, Lao PDR

Sistonen S. 2017. Forest and environmental income dependency in rural livelihoods: A case study of three villages in Mahaxay District, Lao PRD: University of Helsinki.

Stora Enso. 2019. [referred to 1.3.2019]. Available at: https://www.storaenso.com/

UNDP United Nations Development Programme. 2010. Socioeconomic Assessment of Stora Enso Plantation Project in Lao People´s Democratic Republic

Van Der Meer, A., Kanowski, P., Barney, K. 2018. Revealing environmental income in rural livelihoods: evidence from four villages in Lao PDR. [referred to 5.2.2019]. Available at: https://www.tandfonline.com/doi/full/10.1080/14728028.2018.1552540

Zhou, W. 2012. Transnational Paper and Pulp: The Production of Eucalyptus Plantations in China and Laos. University of Oxford.

Young, A. 1991. Agroforestry for Soil Conservation. BPCC Wheatons Ltd, Exeter.

APPENDICES

Annex 1: Village-level Key Informant Interview

Village-level Key Informant Interview

ແບບຟອມສອບຖາມສຳລັບນາຍບ້ານ

Laos, Feb-April 2017

ປະເທດລາວ, ກຸມພາ - ເມສາ, 2017

Basic information of the village/ຂໍ້ມູນທົ່ວໄປຂອງບ້ານ

1. Date / ອັນທີ
2. Start time of the interview/ເວລາທີ່ເລີ່ມສຳພາດ
3. Village head name/ຊື່ຂອງນາຍບ້ານ
4. Village /ບ້ານ
5. District/ເມືອງ
6. Province/ແຂວງ
7. Village no. / ນ້ຳເບີຂອງບ້ານ/ ຈຳນວນຫຼັງຄາເຮືອນ
8. No. of Households/ ຈຳນວນຄອບຄົວ
9. No. of Families/ ຈຳນວນຄອບຄົວ
10. Total Population/ ປະຊາກອນລວມ
11. No. of Women / ຈຳນນວນຜູ້ຍິງ
12. No. of Men / ຈຳນວນຜູ້ຊາຍ
13. Ethnic groups in the village/ ຊົນເຜົ່າ
14. Total land area of the village (ha)/ ເນື້ອທີ່ລວມຂອງບ້ານ (ເຮັກຕາ)
15. Production forest (ha)/ ເນື້ອທີ່ປ່າຜະລິດ (ເຮັກຕາ)
16. Protection forest (ha)/ ເນື້ອທີ່ປ່າປ້ອງກັນ (ເຮັກຕາ)
17. Degraded Forest (ha)/ ປ່າເຊື່ອມໂຊມ (ເຮັກຕາ)
18. Primary forest (ha)/ ປ່າດົງດິບ (ເຮັກຕາ)
19. Shifting cultivation area/ ເນື້ອທີ່ການຖາງປ່າເຮັດໃຫ້ແບບເລື່ອນລອຍທັງໝົດ (ເຮັກຕາ)
20. Shifting cultivation area/year/ ເນື້ອທີ່ການຖາງປ່າເຮັດໃຫ້ແບບເລື່ອນລອຍທັງໝົດ (ເຮັກຕາ)/ປີ
21. Rice Agriculture area/ ເນື້ອທີ່ການປູກເຂົ້າ (ເຮັກຕາ)

22. Other agriculture areas (fruit plantation, coffee plantations etc.)/ ເນື້ອທີ່ກະສິກຳອື່ນ (ສວນໄມ້ໃຫ້ໝາກ, ສວນກາເຟ.....)
23. Hectares Company rented to plantation areas/ ຈຳນວນເຮັກຕາທີ່ບໍລິສັດເຊົ່າເພື່ອເຮັດສວນປູກ
24. Hectares of company rented agroforestry land area/ ເນື້ອທີ່ທີ່ປະຊາຊົນປູກພືດລະຫວ່າງກາງສວນປູກ (ເຮັກຕາ)
25. No. of investors who are operating in the village? / ຈຳນວນຂອງນັກລົງທຶນພາຍໃນບ້ານ

26. No. of household with Excess rice/ ຈຳນວນຄອບຄົວທີ່ຜະລິດເຂົ້າເຫຼືອກິນ
27. Total Rice production, tones per year in the village/ ຈຳນວນຜົນຜະລິເຂົ້າພາຍໃນບ້ານ (ໂຕນ/ປີ)
28. Yield/ha Normal Year/ ຜົນຜະລິດ/ເຮັກຕາປີປົກກະຕິ
29. Yield/ha Good Year/ ຜົນຜະລິດ/ເຮັກຕາປີທີ່ຟ້າຝົນດີ
30. Yield/ha Bad Year/ ຜົນຜະລິດ/ເຮັກຕາ ປີທີ່ຟ້າຝົນບໍ່ດີ
31. Have the crop production amounts increased or decreased in 10 years in the same field area? Why? ຜົນຜະລິດພືດທີ່ປູກເພີ່ມຂຶ້ນ ຫຼື ຫຼຸດລົງຖ້າທຽບໃນ 10 ປີຜ່ານມາ
32. Main NTFPs what people collect in the village nowເຄື່ອງປ່າຂອງດົງຫຼັກໆທີ່ປະຊາຊົນພາຍໃນບ້ານໄປເກັບແມ່ນຫຍັງ?
33. Main type of land where NTFPs are Collected now / ພື້ນທີ່ດິນບ່ອນທີ່ໄປເກັບເຄື່ອງປ່າຂອງດົງ

34. What kind of development projects has there been in the village area?

(ໂຄງການປະເພດໃດທີ່ເຂົ້າມາພັດທະນາໃນພື້ນທີ່ບ້ານ)

35. What would be the best and worst partner to develop the village?

(ຜູ້ທີ່ເຂົ້າມາເປັນຜົນດີ ຫຼື ບໍ່ດີຕໍ່ບ້ານແນວໃດ?

36. Have there been any changes in 10 years in the fertility of land areas?

(ຄວາມອຸດົມສົມບູນຂອງດິນມີການປ່ຽນແປງໄປແນວໃດໃນ 10 ປີຜ່ານມາ)

37. Have there been any positive impacts of plantations or taungya agroforestry sites in the village?
(ເມື່ອມີໂຄງການເຂົ້າມາມັນມີຜົນກະທົບດ້ານວິບຂອງການປູກສອນປູກ ກັບການປູກພືດລະຫວ່າງສອນປູກ)

38. What are the negative impacts of plantations or taungya agroforestry sites for the village?
(ເມື່ອໂຄງການເຂົ້າມາມັນມີຜົນກະທົບດ້ານບວກຂອງການປູກສອນປູກ ກັບການປູກພືດລະຫວ່າງສອນປູກ)

39. What are the main incomes for the villagers? (ລາຍໄດ້ຫຼັກຂອງບ້ານມາຈາກໃສ)
39.2 Income of NTFPs (kip/year)/ ລາຍໄດ້ຈາກການຂາຍເຄື່ອງປ່າ (ກີບ/ປີ)
39.3 Income of livestock/ ລາຍໄດ້ຈາກການລ້ຽງສັດ
39.4 Income of Sale of Rice / ລາຍໄດຕາກການຂາຍເຂົ້າ
39.5 Income from Labour / ລາຍໄດ້ຈາກການຮັບຈ້າງ
39.6 Other sources of income/ ລາຍໄດ້ຈາກແຫຼ່ງອື່ນໆ

40. How has the income sources of the village changed during the past 10 years?
(ແຫຼ່ງລາຍໄດ້ຂອງບ້ານມີການປ່ຽນແປງໄປແນວໃດ 10 ປີຜ່ານມາ)

41. Are the crop yields in the village increasing or decreasing? Why?
(ພື້ນທີ່ປູກພືດເພີ່ມຂຶ້ນ ຫຼື ຫຼຸດລົງຍ້ອນຫຍັງ)

42. Why farmers choose the species what they grow?
    (ເປັນຫຍັງຊາວກະສິກອນຈຶ່ງເລືອກປູກພືດປະເພດນີ້)
43. How many kg can farmer grow rice in taungya agroforestry area?
    (ຊາວນາປູກເຂົ້າໃນລະຫວ່າງແຖວຂອງສວນປູກໄດ້ຈັກກິໂລ)

44. What kind of support the village gets from Stora Enso?
    (ບໍລິສັດສະໂຕລ້າ ໃຫ້ການສົ່ງເສີມດ້ານໃດແດ່)

45. What are the negative and positive effects of the village program?
    (ບໍລິສັດມີຜົນກະທົບດ້ານບວກ ແລະ ລົບແນວໃດຕໍ່ບ້ານ)

46. How would you improve the Stora Enso village program?
    ເຈົ້າມີການປັບປຸງແນວທາງຂອງບໍລິສັດດ້ານໃດ

    Ending time ເວລາສິ້ນສຸດໃນການສຳພາດ _____

Annex 2: Focus Group Discussion

Focus Group Discussion

ການສົນທະນາແບບເປັນກຸ່ມ

Laos, Feb-April 2017

ປະເທດລາວ, ເດືອນກຸມພາ-ເມສາ 2017

Name of the village / ຊື່ບ້ານ:
Village code / ລະຫັດບ້ານ
District / ເມືອງ
Province / ແຂວງ
Date / ວັນທີ
Amount of people in the meeting / ຈຳນວນຜູ້ຄົນເຂົ້າຮ່ວມ
Gender of the people / ເພດຂອງຜູ້ເຂົ້າຮ່ວມ
Start time / ເວລາເລີ່ມ

❖ **General information / ຂໍ້ມູນທົ່ວໄປ**

1. How did the people in the village use land areas 10 years ago (shifting cultivation, Paddy, etc.)? How about now? / ປະຊາຊົນນຳໃຊ້ທີ່ດິນແນວໃດໃນ 10 ປີຜ່ານມາ (ການຖາງປ່າເຮັດໄຮ່, ການເຮັດນາ, ໆລໆ)
   ປັດຈຸບັນເດມີການຳໃຊ້ທີ່ດິນໃນໃດ

2. How did the village people use forest 10 years ago (collect NTFPs, logging big trees, hunting etc.)? How they use now? / ການນຳໃຊ້ປ່າຂອງປະຊາຊົນມີການນຳໃຊ້ແນວໃດໃນ 10 ປີຜ່ານມາ (ການຫາຂອງປ່າຂາຍ, ການຕັດຕົ້ນໄມ້ຂາຍ, ການລ່າສັດ ໆລໆ)
   ປັດຈຸບັນເດນຳໃຊ້ແນວໃດ

3. Is the water in the area (river, well, stream etc.) as clean as it used to be? Why has it changed? / ນ້ຳຢູ່ໃນບ້ານ (ແມ່ນ້ຳ, ນ້ຳສ້າງ ແລະ ຫ້ວຍ.....) ຍັງມີຄວາສະອາດສາມາດນ່ຳໃຊ້ໄດ້ຢູ່ບໍ, ຖ້າຫາກໃຊ້ບໍ່ໄດ້ຍ້ອນຫຍັງມັນຈຶ່ງປ່ຽນແປງ

4. Do the people have more or less rice from the same land area than 10 years ago? Why?
ຜົນຜະລິດເຂົ້າເພີ່ມຂຶ້ນ ຫຼື ຫຼຸດລົງກວ່າເກົ່າໃນພື້ນທີ່ເດີມໃນ 10 ປີຜ່ານມາ, ຍ້ອນຫຍັງ

5. What kind of bad things has happened to the houses, village or the rice (fire, hurricane, draught, pollution, mudslides etc.)? /
ມີສິ່ງໃດທີ່ບໍ່ດີເກີດຂຶ້ນກັບບ້ານ, ເຮືອນ ຫຼື ກັບຜົນຜະລິດ ຫຼື ບໍ່ (ໄຟໄໝ້, ແຜ່ນດິນໄຫວ, ພາຍຸ.....)

6. What kind of outside people are operating in the village?
ມີຄົນທີ່ມາຈາກນອກບ້ານມາເຮັດທຸລະກິດໃນບ້ານຢູ່ບໍ

7. What do they do in the village? / ຖ້າມີພວກເຂົາເຮັດຫຍັງພາຍໃນບ້ານນີ້

8. What land areas are the outside people using the village?
ຖ້າຄົນທີ່ມາຈາກບ່ອນອື່ນມາເຊົ່າດິນ ດິນປະເພດໃດທີ່ເຂົາໃຊ້

9. What kind of work have people in the village made for them?
ແລະອົງກປະເພດໃດທີ່ປະຊາຊົນພາຍໃນບ້ານໄດ້ເຮັດກັບຜູ້ຄົນເຫຼົ່ານັ້ນ

10. What kind of chemicals of fertilizes do the outside people use?
ເຄມີ ຫຼື ປຸ໋ຍປະເພດໃດທີ່ພວກເຂົາໃຊ້ໃນການເຮັດກິດຈະກຳນັ້ນ

11. Has there been any problems with nature, near the areas where the outside peoples operate (polluted water, animals die, mudslides etc.)?
ເກີດບັນຫາກັບສິ່ງແວດລ້ອມ ຫຼື ບ່ໃນບ່ອນທີ່ໃກ້ກັບບ່ອນທີ່ມີການສຳປະທານນັ້ນ (ມົນລະພິດທາງນ້ຳ, ສັດຕາຍ ແລະ ດິນທະຫຼົ່ມ.....)

12. Where the people in the village get money to buy things (NTFP, Livestock, crop, rice, labour etc.)? Where they get money 10 years ago?
ພາຍໃນບ້ານໄດ້ເງິນມາຈາກໃສເພື່ອຈະໃຊ້ຊື້ສິ່ງຂອງໃນຊີວິດປະຈຳວັນ (ຂາຍເຄື່ອງປ່າ ຂອງດົງ, ຈາກການລ້ຽງສັດ.....) ແລະ ໃນ 10 ປີຜ່ານມາເດໄດ້ເງິນມາຈາກໃສ

13. What are the prices of the main crops, now and 10 years ago?
ລາຄາຂອງພືດທີ່ປູກເປັນຫຼັກໃນປັດຈຸບັນ ແລະ 10 ປີຜ່ານມາ

Main food / ອາຫານຫຼັກ	Price and unit / ອາຫານຫຼັກ	Price 10 years ago / ລາຄາ 10 ປີຜ່ານມາ

14. Why do the people in the village choose to grow rice, cassava or other food products (free seeds, market, price, etc.)? / ເປັນຫຍັງປະຊາຊົນໃນບ້ານຈຶ່ງປູກພືດປະເພດນີ້ ຈຳພວກເຂົ້າ, ມັນຕົ້ນ ແລະ ພືດທີ່ນຳໃຊ້ເປັນອາຫານປະເພດອື່ນໆ (ໄດຮັບແນວພັນຟຣີ, ມີຕະຫຼາດ, ລາຄາດີ.....)

15. What kind of land area villagers use for growing food (shifting cultivation, rice paddy, other)? / ປະຊາ◌ົນໃຊ້ດິນປະເພດໃດໃນການປູກພືດເພື່ອເປັນອາຫານ (ການຖາງປ່າເຮັດໄຮ່, ທົ່ງນາ.....)

16. How many people from the village grow rice between the eucalyptus trees, when the trees are small (in 10 years)? / ໃນ 10 ປີຜ່ານມານີ້ມີປະຊາຊົນຈຳນວນເທົ່າໃດທີ່ປູກເຂົ້າລະຫວ່າງຕົ້ນອີກເມື່ອຕົ້ນອີກຍັງນ້ອຍ

17. Have the main forest, crop and non-timber forest products changed in the last 10 years? Why? / ໃນ 10 ປີຜ່ານມາ

ຜະລິດຕະພັນຫຼັກຈາກປ່າ,ເຄື່ອງປ່າຂອງດົງ, ແລະ
ຜົນຜະລິດຈາກປ່າມີການປ່ຽນແປງ ຫຼື ບໍ່ຍ້ອນຫຍັງ

18. If people want to build new road, electricity etc. to the village, where do they get money? / ຖ້າຫາກປະຊົນຕ້ອງການສ້າງທາງໃໝ່,
ຕ້ອງການເອົາໄຟເຂົ້າບ້ານພວກເຂົາເອົາເງິນມາຈາກໃສ

19. Mapping exercise (if village head had no map)
Draw a map of the village area, where the houses are./ ແຕ້ມຜ່ານທີ່
ຖ້າບ້ານນັ້ນບໍ່ມີແຜນທີ.

Ending time / ເວລາສຸດທ້າຍ :_____

Annex 3: Household interview questionnaire

Household interview

ແບບຟອມໃຊ້ສຳລັບສຳພາດຄອບຄົວ

Laos, Feb-April 2017ປະເທດລາວ, ກຸມພາ - ເມສາ 2017

Before we start the interview in the household, please give a short introduction why we are here, who we are and how we select the households. The interview is confidential.
(ກ່ອນຈະເລີ່ມສຳພາດທຸກເຮືອນທຸກແນະນຳຕົນເອງພ້ອມກັບຈຸດປະສົງໃນການລົງເກັບກຳຂໍ້ມູນ)

District name *(code from list)* / ຊື່ເມືອງ	
Village name (*code from list)* / ຊື່ບ້ານ	
Household name / ຊື່ຄອບຄົວທີ່ສຳພາດ	
Date of interview / ວັນເດືອນປີ	_____/_____/ 2017
Starting time / ເວລາເລີ່ມສຳພາດ	

1. Gender *0 = male 1 = female* / ເພດ *0* = ຊາຍ *1* = ຍິງ	
2. Education *0= No education 1= Primary school; 2= Middle school; 3= Secondary; 4= Vocational 5= high school 6= Other, What* *0*= ບໍ່ໄດ້ຮັບ *1*= ປະຖົມ; *2*= ມ ຕົ້ນ; *3*= ມ ປາຍ; *4*= ຊັ້ນກາງ *5*= ຊັ້ນສູງ *6*= ອື່ນໆ, ອາຊີບໃດລະບຸ	
3. Number of the people who live in the same household? **ຈຳນວນຄອບຄົວທີ່ອາໃສຢູ່ໃນຫ້ຽງຄາດຽວກັນ?**	
4. Occupation in the household [1] *Codes: 0= Hh head; 1=spouse (legally married or cohabiting); 2=son/daughter; 3=son/daughter in law; 4=grandchild; 5=mother/father; 6=mother/father in law; 7=brother or sister; 8=brother/sister in law; 9=uncle/aunt; 10=nephew/niece; 11=step/foster child; 12=other family; 13=not related.* ລະຫັດ*: 0*= ຫົວໜ້າ ຄຄ; *1*=ຄູ່ສົມລົດ (ຄູ່ແຕ່ງງານ); *2*=ລູກຊາຍ/ລູກສາວ; *3*=ເຂີຍ/ໃພ້; *4*=ຫຼານ; *5*=ແມ່/ພໍ່; *6*=ແມ່ເມຍ/ພໍ່ເມຍ; *7*=ອ້າຍຫຼື ເອື້ອຍ; *8*=ອ້າຍເຂີຍ/ເອື້ອຍໃພ້ ຫຼື ນ້ອງໃພ້; *9*=ລຸງ/ປ້າ; *10*=ຫຼານຊາຍລ/ຫຼານສາວ; *11*=ລູກລ້ຽງ; *12*=ຄົນຄ້ອອື່ນ; *13*=ບໍ່ກ່ຽວຂ້ອງ	

5. What do you do for living? / ເຮັດຫຍັງໃນການດຳລົງຊີວິດ**?** 1= growing crops and animals 2= growing domestic animals 3=growing crops 4= employee 5= collector of NTFPs 6=Something else, what? 1= ປູກພືດ ແລະ ລ້ຽງສັດ 2= ລ້ຽງສັດ 3=ປູກພືດ 4= ຮັບຈ້າງ 5= ຊອກເຄື່ອງປ່າ 6=ອື່ນໆ, ລະບຸ?	
6. Where do you get money for living? / ຫາເງິນມາໃຊ້ໃນຊີວິດປະຈຳອັນຈາກໃສ**?** 1= selling cassava 2= selling animals 3=selling NTFPs 4= I work for company 5= selling handcraft 6= Selling rice 7= Selling bananas 8=Something else, what? 1= ຂາຍມັນຕົ້ນ 2= ຂາຍສັດລ້ຽງ 3=ຂາຍຂອງປ່າ 4= ເຮັດວຽກກັບບໍລິສັດ 5= ຂາຍເຄື່ອງຫັດຖະກຳ6= ຂາຍເຂົ້າ 7= ຂາຍກ້ວຍ 8=ອື່ນໆ ລະບຸ?	
7. What food do you grow for eating? / ພືດອາຫານຊະນິດໃດທີ່ປູກເພື່ອດຳລົງຊີວິດ**?** 1= rice 2=maize 3=jobs tear 4=vegetables 5= *fruits 6= bamboo shoots 7= mushrooms 8=other, what?* 1= ເຂົ້າ 2=ສາລີ 3=jobs tear 4=ຜັກ 5= ໝໍ່ໃຫ້ໝາກ *6=* ຫນໍ່ໄມ້ *7=* ເຫັດ *8=*ອື່ນໆ ລະບຸ*?*	
8. Where do you grow your food? / ປູກພືດເລົ່ານີ້ຢູ່ໃສ**?** 1= Shifting cultivation 2=Paddy 3= I have no land 4=Only in the garden 5=Other, What? 1= ໄຮ່ເລື່ອນລອຍ 2=ທົ່ງພຽງ 3= ບໍ່ມີດິນ 4=ໃນສວນ 5=ອື່ນໆ?	
9. What do you collect for eating? / ເຈົ້າຫາຫຍັງເພື່ອກິນ**?**	
10. **How many hectares do you use land to grow food? /** ເຈົ້າໃຊ້ດິນໃນການປູກເຂົ້າຈັກເຮັກຕາ**?**	
11. Do you have cattle (cow, goat, and buffalo)? / ເຈົ້າມີສັດກະເພາະລວມບໍ (ງົວ, ແບ້, ຄວາຍ)**?**	
12. Where does your household raise cattle if there is plantation in the village? / ເຈົ້າລ້ຽງສັດຢູ່ໃສຖ້າຫາກໃນບ້ານມີສວນປູກ**?**	
13. Who decides when new investments company wants to come to the village? / ໃຜເປັນຜູ້ຕັດສິນໃຈຖ້າຫາກມີໂຄງການເຂົ້າມາ**?**	

0= Village head 1=village meeting 2=District officers 3=Government 4=Someone else, who? *0=* ນາຍບ້ານ *1=*ກອງປະຊຸມພາຍໃນບ້ານ *2=*ຫ້ອງວ່າການປົກຄອງເມືອງ *3=*ລັດຖະບານ *4=*ໃຜບາງຄົນ ລະບຸ*?*	

14. What kind of outside people are operating in the village?

(ຄົນພາຍນອກມາສຳປະທານເຮັດກິນຈະກຳຫຍັງຢູ່ພາຍໃນບ້ານ**)**

15. What do they do in the village? (ພວກເຂົາເຮັດຫຍັງໃນບ້ານ**)**

16. What land areas are the outside people using the village?

(ດິນແບບໃດທີ່ຄົນທີ່ມາຈາກທາງນອກມາສຳປະທານ**)**

17. What kind of work have you made for them?

(ເຈົ້າໄດ້ເຮັດວຽກຫຍັງແດ່ໃຫ້ພວກເຂົາ**)**

Have you ever grown rice in between Stora Enso´s eucalyptus trees?

1= No, Why not? 2= Yes

ເຈົ້າເຄີຍປູກເຜືດຢູ່ລະຫວ່າງຕົ້ນໄມ້ໃນສວນປູກ ຫຼື ບໍ ?

1= ບໍ່, ຍ້ອນຫຍັງ*? 2=* ເຄີຍ

How much have you got seeds for from Stora Enso?

(ເຈົ້ນໄດ້ຮັບແນວພັນຫຼາຍເທົ່າໃດຈາກ ບໍລິສັດStora Enso)

How many bags of rice can you grow between Stora Enso eucalyptus trees?ໄດ້ເຂົ້າຈັກກະສອບ

How many hectares of land did you use for growing food, before SE came to grow the trees? / ກ່ອນວ່ວິສັດຈະເຂົ້າມາເຈົ້າໃຊ້ດິນໃນການປູກເຂົ້າຈັກເຮັກຕາ

How are the water areas near Stora Enso´s eucalyptus trees? / ນ້ຳທີ່ຢູ່ໃກ້ສອນປູກບ່ວິສັດເປັນແນວໃດ?

Have you ever worked for Stora Enso?

1= No 2= Yes

ເຈົ້າໄດເຮັດວຽກໃຫ້ ບ່ວິສັດບ່

1. ເຮັດ, 2 ບ່ເຮັດ

How often did you work and what did you do? / ເຈົ້າເຮັດວຽກຈັກເທື່ອ

18. **Who of the household members works outside farm (in the last 12 months)?**

(ມີໃຜໃນຄອບຄົວທີ່ໄປເຮັດວຽກກັບບໍລິສັດທີ່ບໍ່ແມ່ນເຮັດກະສິກຳ **(12** ເດືອນ**)**

1. Household member *0= Hh head; 1=spouse (legally married or cohabiting); 2=son/daughter; 3=son/daughter in law; 4=grandchild; 5=mother/father; 6=mother/father in law; 7=brother or sister; 8=brother/sister in law; 9=uncle/aunt; 10=nephew/niece; 11=step/foster child; 12=other family; 13=not related.* *[1] ລະຫັດ: 0= ຫົວໜ້າ ຄຄ; 1=ຄູ່ສົມລົດ (ຄູ່ແຕ່ງງານ); 2=ລູກຊາຍ/ລູກສາວ; 3=ເຂີຍ/ໄພ່; 4=ຫຼານ; 5=ແມ່/ພໍ່; 6=ແມ່ເມຍ/ພໍ່ເມຍ; 7=ອ້າ ຫຼື ເອື້ອຍ; 8=ອ້າຍເຂີຍ/ເອື້ອຍໄພ່ ຫຼື ນ້ອງໄພ່; 9=ລຸງ/ປ້າ; 10=ຫຼານຊາຍ/ຫຼານສາວ; 11=ລູກລ້ຽງ; 12=ຄົບຄົວອື່ນ; 13=ບໍ່ກ່ຽວຂ້ອງ*	**2. What kind of work** 1= construction 2= driver 3=worker in another farm 4= worker in plantation areas 5= service sector 6= shop 7= other, what? 1= ກໍ່ສ້າງ 2= ຂັບລົດ 3=ກຳມະກອນຢູ່ຟາມອື່ນ 4= ເຮັດວຽກໃນສວນປູກ; 5= ການບໍລິການທ່ອໄປ6= ຂາຍເຄື່ອງ 7= ອ່ນໆ ລະບຸ,?	**3. Number of days work** - total for the past 12 months e.g. worked 5 days per week for 3 months **ຈຳນວນມື້ໃນການເຮັດວຽກ** **- ລວມ 12 ເດືອນທີ່ຜ່ານມາ** **ຕົວຢ່າງເຮັດວຽກ 2 ມື້ຕໍ່ອາທິດ / 3 ເດືອນ**	**4. Daily wage** (kip) **ລາຍລະອຽດເງິນ**

19. Other income

Incomes that the household has received in 12 months /ລາຍໄດ້ແຫ່ງອື່ນໆ ລາຍໄດ້ທີ່ໄດ້ຮັບໃນ 12 ເດືອນ.

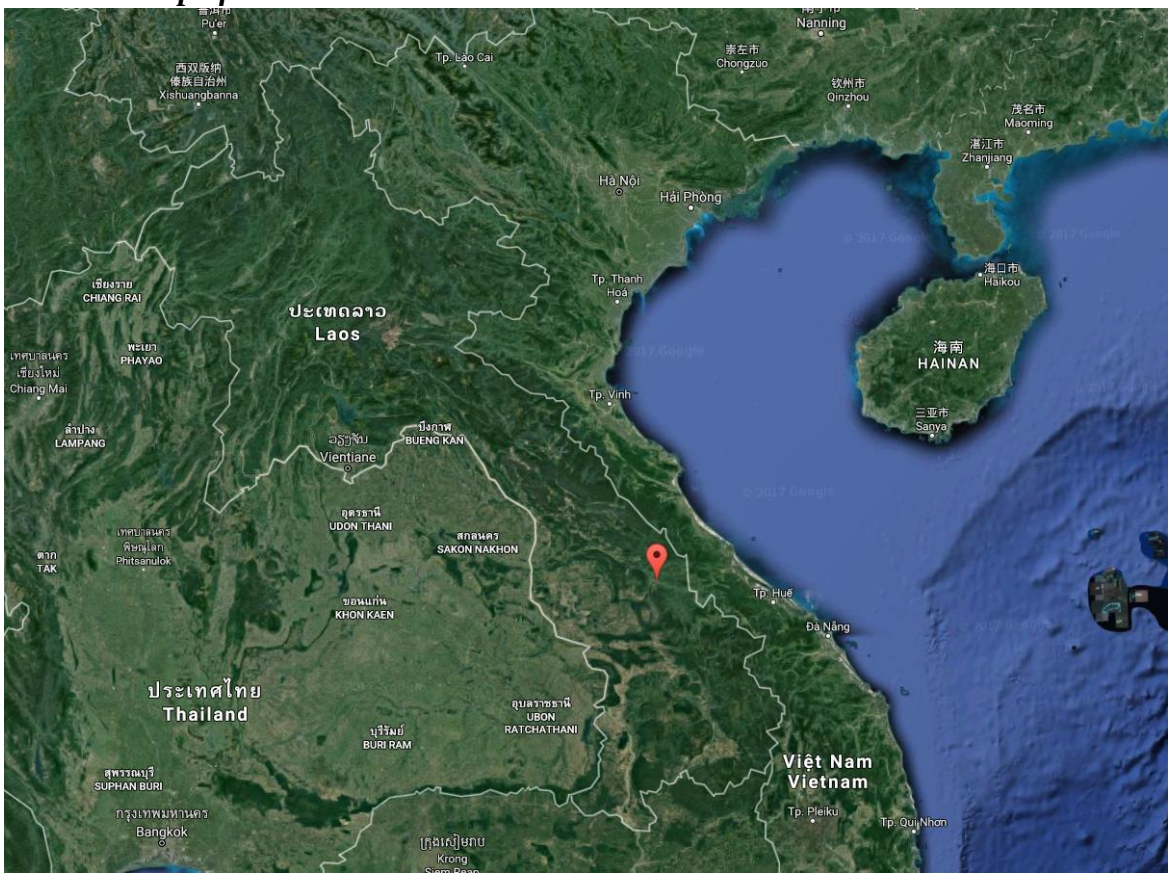
1. Type of income ປະເພດຂອງລາຍໄດ້	**3. Total amount in the past 12 months** *(kips)*
1. Remittances from the family members ຈາກລູກຫຼານທີ່ໄປເຮັດວຽກບ່ອນອື່ນ	
2. Support from government, NGO, organization or similar (seeds, animals etc.) ການຊ່ວຍເຫຼືອຈາກລັດຖະບານ, ອົງການຈັດຕັ້ງທີ່ບໍ່ຂຶ້ນກັບລັດ (ແນວພັນພືດ, ສັດ etc.)	
3. Payment for forest services (*REDD/forest carbon, water catchment project, conservation, tourism*) ການຈ່າຍຈາກການບໍລິການນຳໃຊ້ປ່າໄມ້(ອາຍກາກໂບນິກ,ໂຄງການການເກັບນ້ຳt, ປ່າສະຫງວນ, ການທ່ອງທ່ຽວ)	
4. Does your household get any payments or support of any company for land use etc.? ໄດ້ຮັບເງິນຈາກການເຊົ່າດິນ etc.	
5. Compensation from logging or mining company (or similar) / ບໍລິສັດຕ່າງ	
6. Payments from forest user group ຈ່າຍຈາກພວກນຳໃຊ້ປ່າໄມ້	
9. Other, specify: ອື່ນໆ ລະບຸ:	

12.1 Main income sources		**12.2 Amount of own use (subsistence) in local units**. *(kg, ton, bundles etc.)*	**12.3 Amount sold (cash) in local units** *(kg, ton, poles, baskets, bundles etc.)*	**12.4 Time period** total for 1 month or 12 months	**12.5 Price per unit for what they sold** (Kip)
Crop					
1.					
2.					
3.					
Fruit					
1.					
2.					
3.					
Domestic animals	**Number of owned**				
1. (*most imp.*)					
2.					
3.					
Timber or tree for cash purpose					
1.					
2.					
3.					
NTFPs *(from forest land)*					
1.					
2.					
3.					
Firewood *(charcoal inc. goes in business section)*					

11.1 Main income sources	**Amount of own use (subsistence) in local units** *(e.g. kg, ton, bundles etc.)*	**11.6 Amount sold (cash) in local units** *(e.g. kg, ton, poles, baskets, bundles etc.)*	**11.5 Price per unit for what they sold** (Kip) *value of own use*	**11.4 Time period** total for 3 months, or 12 months Or - per month for X months a year
Other wild/ env. products *(e.g. aquatic resources, grass)*				
1.				
2.				
3.				
Rubber				

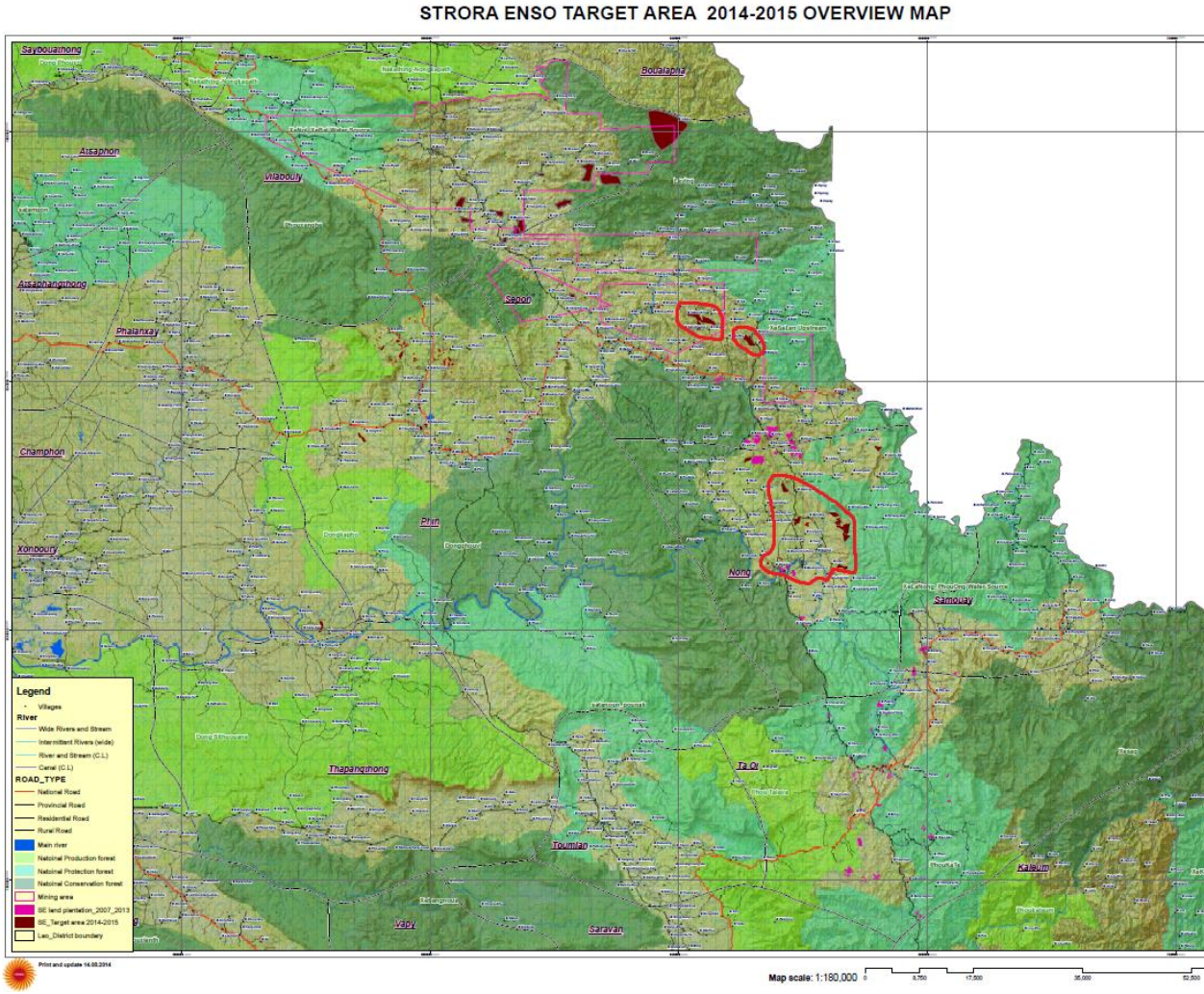
Ending time/ ເວລາສຸດທ້າຍ:_____

Annex 4: Map of Laos

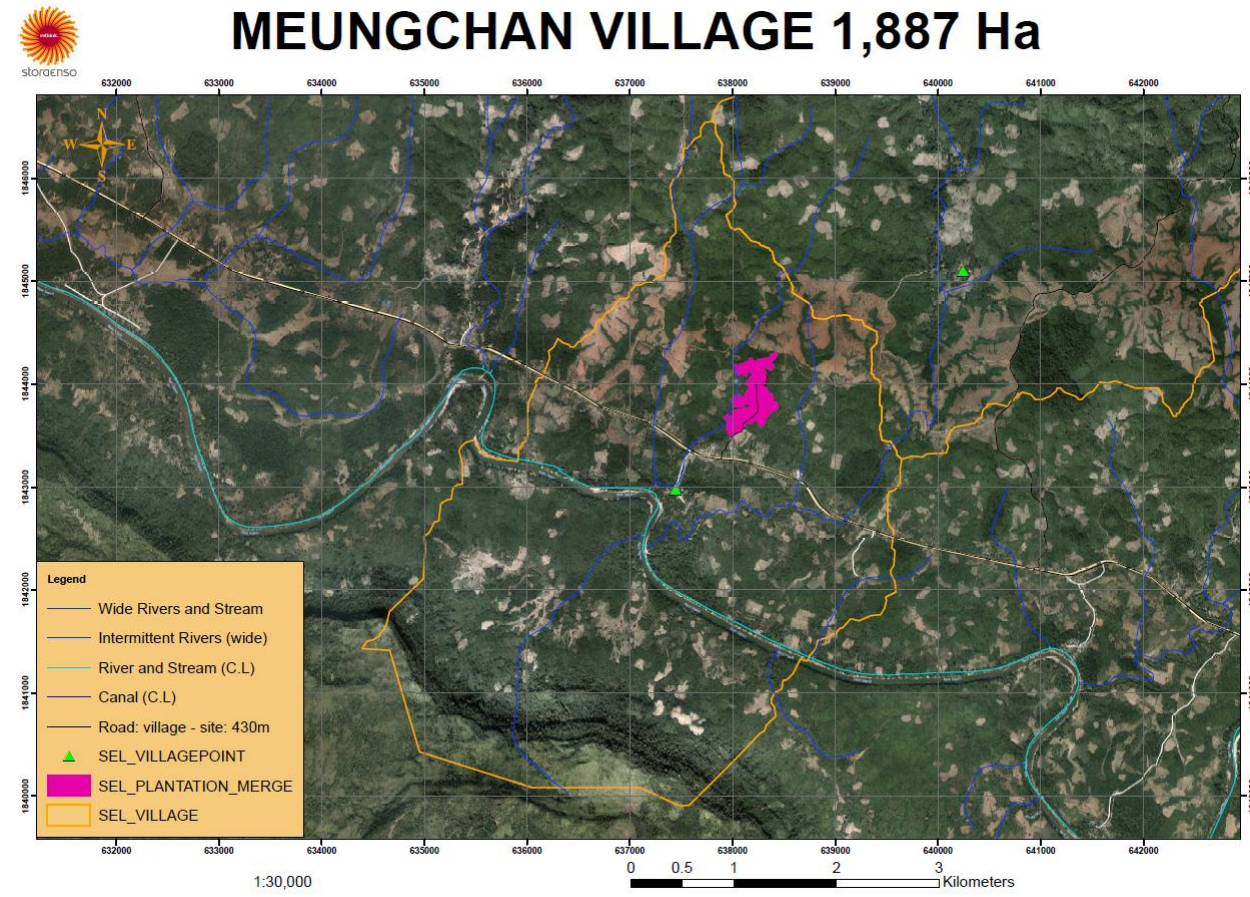


Annex 5: Location of Stora Enso plantations

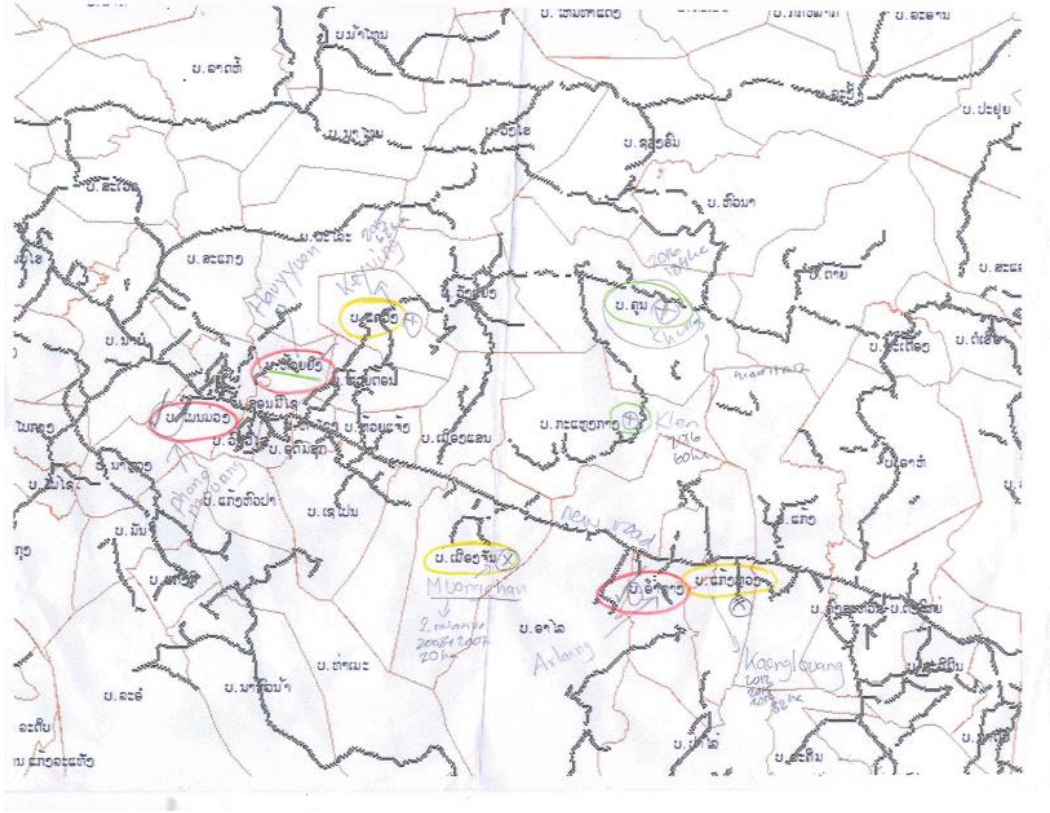
Annex 6: Location of research areas



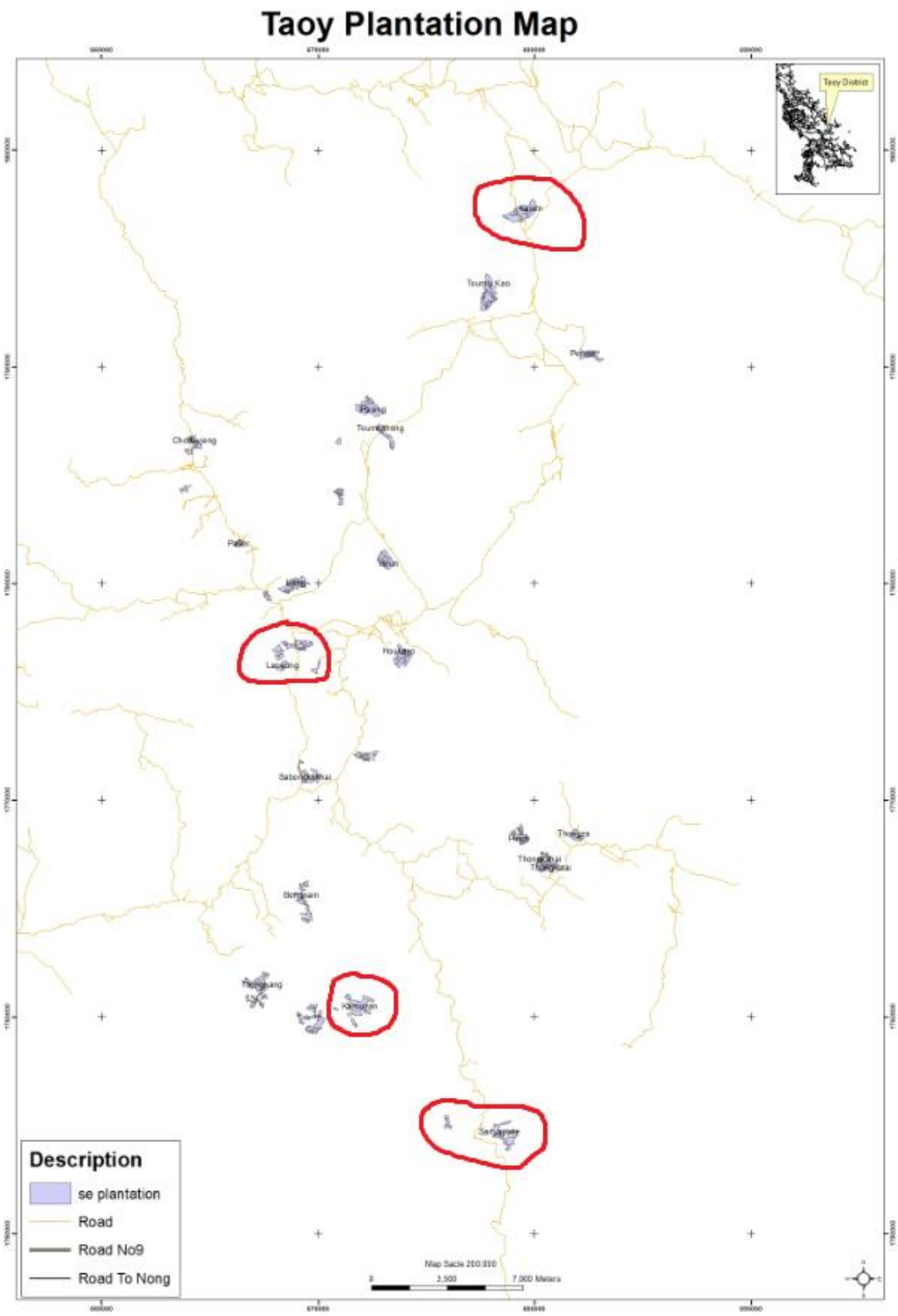
Annex 8: Muangchang village map



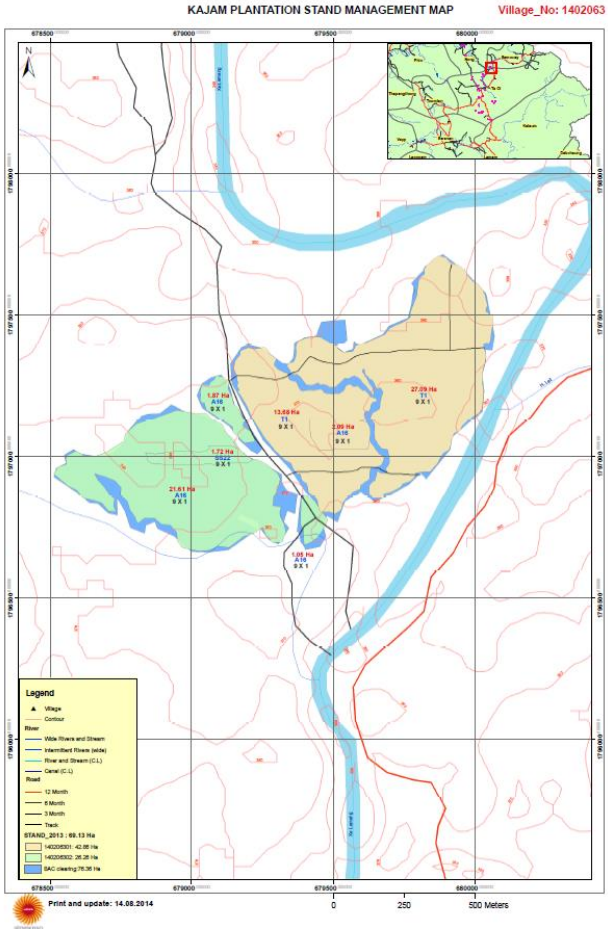
Annex 9: Sepon plantation map



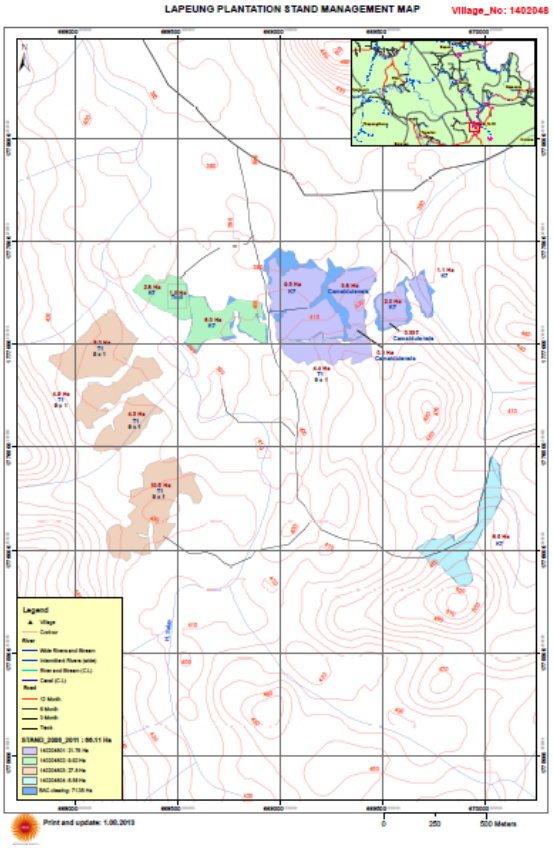
Annex 10: Ta Oi plantation map



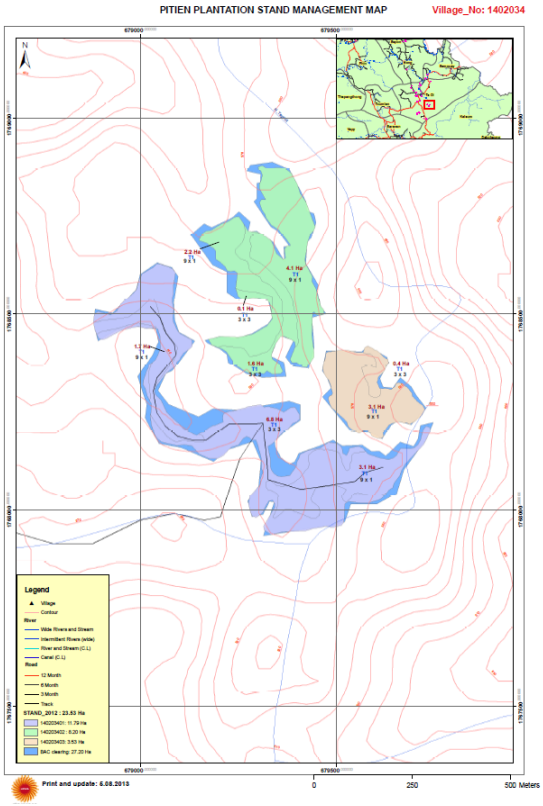
Annex 11: Kajam plantation stand map



Annex 12: Lapeung plantation stand map



Annex 13: Pitiean plantation stand map



Annex 14: Sanyaone plantation stand map